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EDITORIAL ANNOUNCEMENTS

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages and all of the advertisement pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Transport and Railroad Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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It is said that a gathering of officers of the Pennsylvania railroad at Buffalo recently agreed that it was feasible to abolish a hundred report forms and that this abolition will be carried out. Whether this indicates that the Pennsylvania has been afflicted with an unusual burden of red tape or that it has officers gifted with unusual courage in the application of common sense, we do not know; but the fact is worth noting. It may jog the officers of some other roads into action to relieve the overburdened station agent. Perhaps in some cases such action would relieve the pay-roll instead of the agent—for there is no doubt that in some offices the abandonment of useless daily and weekly reports would make it possible to get along with one clerk less. Whichever it is, the need of the change exists, no doubt, on many roads. To bring about true economy in this matter, the three departments interested—the operating, the traffic and the accounting—must co-operate; for when acting independently each is likely to ask the agent to repeat what he has already done for one of the others. The use of the carbon duplicating process is not always availed of to the fullest possible extent. A department officer should put up with a carbon report containing matter that he does not want, rather than require a separate report which entails mere copying labor, and saves nothing but a little paper. It is said that on roads where the long distance telephone is freely used, the officers have been able to dispense with a good many written reports by substituting oral communications. Instead of requiring the transmission by letter or telegraph of reports containing a hundred or a thousand facts, of which not more than one will be used, the one that does happen to be wanted is asked for by telephone. This expedient, combined with the Pennsylvania scheme, ought to make possible the accomplishment of material progress toward the general introduction of the Simple Life in railroading.

The new President of the Long Island Railroad, Mr. W. F. Potter, has commenced the publication in the New York newspapers of what will presumably be a series of bulletins on the unusual situation which confronts his property, with a view to clarifying public opinion. The recent announcement that some of the suburban passenger rates were to be raised brought a shower of abuse on the road. Mr. Potter now points out that the basis of the policy of his company is faith in the future of Long Island, and that this faith has been demonstrated by the development of plans for spending nearly $40,000,000 upon extraordinary improvements to enable the road to utilize expenditures by allied corporations to the additional amount of over $50,000,000, and also by the maintenance for many years of low passenger fares in spite of loss and non-payment of dividends. He points out that the railroad has been forced to increase its passenger rates because they were below the cost of transportation; that during the last fiscal year the average earnings per passenger mile on the line amounted to 1.44 cents, while the average cost of carrying each passenger one mile was 1.548 cents, and this loss on each passenger resulted in a total deficit of over $275,000. This condition resulted from the unique circumstances attending the operation of a road with no through business and only a short business season during the summer months; also from the vast increase in the cost of operation resulting from the rise in the cost of fuel, supplies and labor. Facing these facts, the Long Island Railroad has acted on the assumption that its patrons would prefer to pay somewhat higher rates in order that the quality of the service might be improved rather than reduced, and that needed improvements might not be delayed. There is nothing unusual in retrenchment by raising rates, although it is generally the freight traffic which feels the change. The interesting feature of this circular lies in the fact that the president of a railroad which is being criticized in the public press is taking the public frankly into his confidence. This policy has much to recommend it, and it seems certain that there would be far fewer cases of the strained relations so frequently found between railroads and communities if the railroads would frankly say what they were doing and why they were doing it. The general public is not disposed to be unreasonable when it is well informed, and the intense hostility exhibited toward railroad corporations in some quarters is almost sure to be the result of misconstruction of the railroad's motives, founded on a lack of information as to the true facts, for which the railroad company is certainly primarily responsible. In view of the fact that the two classes of persons directly interested in a railroad—the owners of the road, on the one hand, and the shippers (or travelers) on the other—are closely interdependent on each other for mutual welfare, it seems surprising that in common practice circulars of explanation are directed almost wholly to the owning class, while the customer class is left in the dark, and is thereby encouraged to become a hostile critic of the management. Entirely apart from the justice of his claims, which have been upheld in previous issues of the *Railroad Gazette*, Mr. Potter's method of making these claims popularly and widely understood is worthy of the highest praise.

THE DEPARTMENT vs. THE RAILROAD.

A railroad mechanical officer of long experience who was asked recently what matter he would be most interested to see discussed, replied that something surely needed to be done to secure to railroad mechanical departments the high place in the esteem of the managements that their importance warrants, and also to secure the co-operation between the mechanical and other departments, particularly the operating, that is so highly essential to the best working of the railroad.

In the first of these points this officer voices a feeling of discontent that appears to be quite generally prevalent among the mechanical men of railroads, and which has spread and deepened as railroad systems have grown and expanded. To say that the

extent and intensity of the feeling prevailing on any road is in proportion to its size would not, of course, be true; but the changes in methods of supervision, control and operation growing out of the formation of the large systems have undoubtedly been influential in creating and fostering the sentiment referred to. Since a railroad is a huge transportation machine, with trains the principal and most important part of the mechanism, the mechanical department, as the one charged with the responsibility for the design and maintenance of this mechanism, rightly claims a foremost place in importance. Yet many mechanical officers complain that, although chosen ostensibly because of their ability and intimate knowledge of the requirements peculiar to the work, their authority is circumscribed until in many cases they are practically without discretion in important matters in their own department; that their recommendations fail to receive due consideration, although they are held rigidly accountable for results for which the requisite authority and effective facilities are denied them.

It is unfortunately true that such a condition of affairs does exist on some roads. But many managements already appreciate the situation, and others are waking up to a proper understanding of the importance and difficulty of the problems with which the mechanical department must cope. The need for adequate shops and engine terminals has been met, in many cases with extreme liberality. A realization, somewhat belated perhaps, of the responsibilities and demands laid not only on the motive power superintendent but on his subordinate officers—master mechanics, roundhouse foremen, etc.—has bred surprise and respect and with them a willingness to empower these men by the needful authority and facilities to meet their difficulties in a manner commensurate with their importance. The extent to which this matter is receiving attention is indicated by a remark reported to have been made by a railroad president, to the effect that mechanical department problems of a great railroad cannot properly be dealt with by an officer lower in grade and authority than a vice-president.

Comment on the second point mentioned by the officer quoted at the outset, namely, co-operation, must unfortunately be less optimistic in tone. The intimate relation existing between the operating and mechanical departments requires that they work together in closest harmony if the best efficiency of the machine is to be realized. Unfortunately the reverse is often the case. Many superintendents apparently derive satisfaction from causing embarrassment to the motive power department and regard its difficulties with indifference. Interested only in moving the largest number of cars with the least expenditure of power, locomotives are loaded until they can barely crawl over the road, causing failures that would be avoided with a few less cars. One department blames the other for troubles for which both perhaps are to blame, or in the words of one officer, "each department is constantly studying how it can 'unload' on the other." A master mechanic recently said that if he had to go through his preparatory course again, he would devote a good part of the time to perfecting himself in hypnotism, so that he could hypnotize the general manager. In contrast to this is the statement made by an officer of a western road which had been notably successful in prompt and efficient movement of its freight trains during the memorable congestion of two winters ago. Asked the reason, he said it could be given in one word—co-operation; the departments all pulled together for the good of a common cause. This spirit, he claimed, existed at all times, and the period of unusual stress made its benefits more clearly apparent by the contrast with conditions elsewhere. In order that harmony of working may prevail, it is necessary that each department be ready to make concessions to the others. The golden rule is as applicable to railroading as it is to other affairs of life.

Mr. Tuttle's Answer to Mr. Schurman.

The controversy between President Tuttle, of the Boston & Maine, and President Schurman, of Cornell University, has brought out some interesting literature on the subject of Federal rate regulation. Mr. Tuttle's rebuttal to Mr. Schurman's reply to his previous paper takes up again the scope of the Commission's proposed rate-making power and also answers the statement frequently made by the Commission that it exercised this power during the first few years of its existence without serious impairment of railroad earnings. Mr. Tuttle discussed this point as follows.

The main point recommended by the President and now under consideration by Congress is that the Interstate Commerce Commission shall be given the power to fix rates; and as to this I notice that you follow the line of reasoning adopted by nearly every one who favors this enlargement of power in saying that no power will be given "to fix even one single rate definitely, nor to touch any rate whatever, of its own motion, and on its own initiative." To the allegation that the power to fix, upon complaint, a single rate or regulation, will not give the Commission a further power to make rates generally, and to the statement often made in support thereof that during the first few years of its existence the Commission did make rates and no serious impairment of railway earnings ensued, I answer: While I was with Mr. Albert Fink as one of the commissioners of the Trunk Line Association, Judge Cooley, who was chairman of the Interstate Commerce Commission, held not infrequent personal discussions of this matter with us, and I know that he did not then believe that the Commission was lawfully endowed with the power to fix rates. It is, however, true that the Commission afterward, and for several years, exercised this power without serious protest from the railroads, although it is also true that they were always advised by counsel that the Commission was exercising this power unlawfully. But so long as the Commission's rulings dealt only with cases here and there and were not, as a whole, found seriously harmful, the railroads permitted the matter to go on until there was a culmination in its decision of the case of "Freight Bureau of the Cincinnati Chamber of Commerce against the Cincinnati, New Orleans and Texas Pacific Railway company, et al.: Chicago Freight Bureau against the Louisville, New Albany and Chicago Railroad Company, et al. (6 Interstate Commerce Reports 195)."

Mr. Tuttle then explained these two cases and referred to the sweeping decree of the Commission ordering the railroads not to make rates from Cincinnati and Chicago to certain points in the south in excess of those contained in a table of rates which it prepared and made a part of its decree and which it adjudged just and reasonable. Upon the refusal of the railroads to obey this decree the case was carried up to the Supreme Court, which held, through Justice Brewer, that the Commission had no power to pass such an order.

Mr. Tuttle also made the following reply to Mr. Schurman's contention that the Government by the fact that it establishes a maximum rate is not compelled to establish a minimum rate also.

You ask, "Why must the government, if it fixes a maximum rate, also fix a minimum rate?" and you say that my statement that it must do so being the weakest link in my argument, it wholly fails. That whoever exercises the power to fix the maximum price of transportation must likewise and by the use of like power fix the minimum price is a fact so elementary and self-evident to every one versed in railroad operation and traffic that I did not suppose it needed argumentative support, but as you question its logic let us look into it. Whenever the government prescribes a reasonable and just transportation rate, its reasonableness and justness must of necessity apply proportionately to the carrier, the shipper, the producer and the purchasers and users of the commodity or product transported; consequently, from all points of view, this rate, when so prescribed must, because it is reasonable and just, at once become the only rate that can be rightfully charged by the carrier or paid by the shipper, and it therefore is, in equity, the minimum as well as the maximum rate chargeable and payable for the prescribed service. This is true not only as affecting the particular carriers and customers doing business in the prescribed locality, but also as to other transporation companies serving other, and perhaps widely separated, localities and customers, under like or similar conditions.

Now suppose the government fixes rates for the transportation from Chicago to New York of these necessary and widely used articles; it must be assumed that these rates, because they are just and reasonable shall not only be uniformly charged by the carrying agency, but likewise paid, or shared in, by the producer and shipper as well as by the New York purchasers and consumers, and these rates therefore at once become for the Chicago and New York transportation lines affected, and for the Chicago sellers and the New York consumers, the minimum as well as the maximum rates that may be equitably charged and paid. This cannot be otherwise than true if the rates are just and reasonable. But suppose other lines of transportation not included within the government order prescribing the Chicago and New York rates shall decide to place their prices for carrying these same widely needed articles from Chicago to Baltimore, Philadelphia or Boston materially below the just and reasonable rate that has been fixed by the government for similar Chicago to New York transportation, will not fairness and equity demand that the government again and at once intervene in behalf of the New York consumer and prescribe that the just and reasonable rate it has fixed between Chicago and New York shall apply to like shipments made under like and similar conditions from Chicago to Baltimore, Philadelphia and Boston; and if it declines to do so, will not the preference thereby given to the three last named communities work such an injustice to merchants and consumers in New York that they will rightfully demand that the government make another and lower just and reasonable rate from Chicago to New York in substitution for that which it has only recently prescribed as the just and reasonable rate? And must not this process of continually substituting lower just and reasonable rates go on until there is inextricable confusion, or the power that makes maximum rates performs its plain duty of fixing minimum rates that shall not be departed from by any carrier doing like and similar business between like or similar communities?

The general managers of the principal railroads in Texas have taken steps to form an association for making public some of the doings and the opinions of the railroad companies; in other words, to try to influence the people of Texas to be more reasonable in their feelings towards the railroads. A clause in the articles of organization stipulates that the association shall do nothing unlawful, and that its counsel shall not appear before any committee of the legislature or have any communication with any member of the legislature touching anticipated legislation. It is said that ex-Governor J. D. Sayers has been employed, at a salary of $7,000 a year, to be the special representative of this new organization. The duties of the special representative are defined as follows:

The Counsel shall represent the Association in dealing with the public, and it shall be his duty to bring about a better understanding by correcting false impressions, made by incorrect information given to the public, and it will be his special duty to call the attention of the Association or the attention of individual members

to anything which, in his opinion, the railroads should or should not do in serving the public; the first object of the Association being to bring about a better condition of affairs whereby the people and the railroads will be dealt with by each other fairly and correctly, the belief being that the people of Texas will treat the railroads fairly if they understand them.

This commendable work was well begun three years ago by Mr. Markham, the former manager of the Southern Pacific Lines in Texas, who is now out of the railroad service. He, practically single handed, worked a noticeable purification of public sentiment concerning fraudulent lawsuits and unjust verdicts against railroads. He worked for his company but he really benefited the people, for they were making themselves infamous. Only by being pretty frank with the people and the legislatures can a railroad officer be truly public spirited; and if not public spirited he is not fulfilling his mission. By "pretty frank" we mean frank in a much larger variety of matters than are usually treated in that way at present. The Texas managers, like Mr. Potter, of the Long Island, and others who are ready at all times to declare their principles and to stand cross questioning by any fair minded authority, do a real public service. We are constrained to add, however, that one swallow does not make a summer. There should be a hundred imitators of Messrs. Markham and Potter.

The Interstate Commerce Commission has issued its preliminary report on the income account of railroads in the United States for the year ending June 30, 1904, which is of interest as bringing up certain totals of operation a year ahead of those printed in the last number of *Poor's Manual*. According to this report, the average income per mile of line from the 209,002 miles of railroad reporting for the last fiscal year, was $6,592 from freight service, $2,581 from passenger service, and $237 from other earnings from operation, making a total of $9,410 per mile. In 1903, freight earnings were $6,539 per mile, passenger earnings $2,492 per mile and other earnings from operation $227 per mile, a total of $9,258 per mile from 205,314 miles of line represented. The aggregate for the past fiscal year, therefore, was somewhat in excess of that for 1903, or for any previous year, in spite of the many unfavorable traffic circumstances; but operating expenses aggregated $6,375 per mile as against $6,125 per mile last year, leaving net income from operation $3,035 per mile in 1904 as against $3,133 per mile in 1903. Total gross earnings are reported as $1,966,633,821, of which freight earnings contributed $1,377,684,976 and passenger earnings $539,428,374. Total operating expenses were $1,332,382,948, leaving net income from operation $634,250,873. Gross earnings for the year ending June 30, 1903, were $1,900,846,907.

According to the preliminary report under consideration, the operating companies declared dividends during the year to the amount of $184,450,446, while practically the same roads during 1903 declared dividends aggregating $160,856,307, indicating an increase of $23,594,139. These figures, however, do not include a statement of the dividends that are declared by such subsidiary companies as have leased their property to others for operation. The income of these companies for the most part is derived from the rents which are paid by their lessees and from which their own corporate expenditures, including dividends, are made. It is estimated that the dividends distributed by the lessor companies among their stockholders for the year 1904 were $34,000,000 or more.

The bill to empower the President to give bronze medals to heroes who, by extreme daring, endanger their own lives in saving others or in endeavoring to save them, on railroads, has been passed by Congress and signed by the President. The Senate Committee report seems to indicate that Secretary Moseley, of the Interstate Commerce Commission, has been the prime mover in securing this legislation, and the President has given to him the pen with which the bill was signed. Mr. Moseley is an old sailor, and his acquaintance with the dangers of the deep and the action of the Government in the matter of medals for heroes of the sea apparently suggested to him this action in behalf of railroad men. He says that the medals are to be made of bronze, rather than of a more precious metal, so as to more clearly emphasize the moral significance of the memento. This is a good idea. If any railroad hero needs gold the Carnegie Fund can be appealed to; Mr. Carnegie was formerly a railroader.

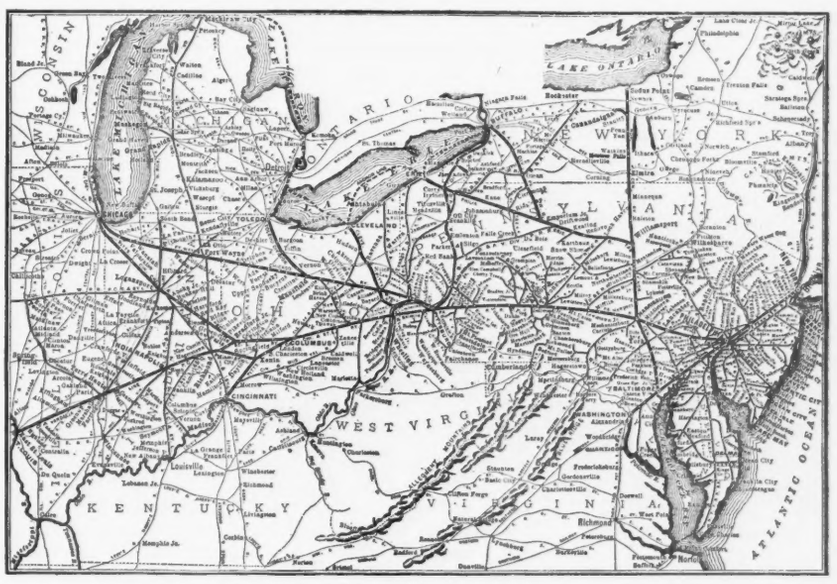
Porters in Pullman sleeping cars now use three sheets in each berth, the third being put outside to cover the blanket and keep it from being soiled. Thus it is expected that the death-dealing bacterium will find no hiding place more attractive than cold linen (or cotton); and in the morning he finds himself bundled off to the laundry, where he is scalded to death and hung up to dry. The Pullman Company began some months ago the use of very long sheets, folding them down over the blanket half a yard or more; but evidently that did not prove acceptable to all of the critics, so now the company goes the whole figure. We shall have to be more careful hereafter about classing the railroad physicians' discussions as wholly academic; their influence seems to be having a visible effect.

Pennsylvania Railroad.

The report for the year ending Dec. 31, 1904, is now at hand. The general income account of the Lines East shows a decrease of almost 4½ millions in gross earnings, as a natural result of a rather hard year; but it is also very noteworthy that the attempts at retrenchment to meet the situation succeeded in knocking almost three millions off the operating expenses, as compared with the year previous, so that the resultant net earnings from operation are only about 1½ millions less than they were in 1903. Moreover, the rentals paid roads operated on the basis of their net earnings, which are to be deducted from the aggregate net earnings, were considerably smaller this year than they were last, so that the final net operating earnings amount to $29,603,672 for the current year as compared with $30,471,902 in 1903, a decrease of only $168,229. This is a very creditable showing, in view of the fact that gross earnings fell off from $122,626,419 in 1903 to 118,145,270 in 1904.

To these net operating earnings must be added the interest from investments of the Pennsylvania Railroad Company, considerably higher this year than last; interest on securities of the United New Jersey Railroad & Canal Company, interest from branch and other roads for use of equipment, interest on the general account and profits from sundry accounts. All of these items, except the last named, showed increases during the last fiscal year, and brought the company's gross income up to $41,017,936 as against $41,214,862 last year. Deducting from this gross income payments for interest, rentals and taxes, the resultant net income amounted to $27,990,867, an increase of $484,359 over the net income for 1903, which had hitherto been the most profitable year in the company's history, as measured by this final statement of net income. These figures cover a system of 5,874 miles, east of Pittsburg and Erie, as against 5,852 miles last year.

The advance sheets now at hand contain the income accounts of only two of the operating companies west of Pittsburg; the Pennsylvania Company and the Pan Handle; omitting the Grand Rapids & Indiana and the independent companies west, which are only included in the general total for the system. On the Pennsylvania Company gross earnings for the year were $36,390,582, a decrease of $212,353 from 1903, while operating expenses aggregated $26,043,362, reduced $1,073,322 from the figure for 1903. This left net earnings from operation $10,347,220; $860,969 higher than in the previous year; but deductions on account of rentals were higher than in 1903 instead of lower, as was the case on the Lines East, and the net operating earnings for the year amounted to $8,292,869, an increase of not quite $400,000 over the results in 1903. Dividends and interest received from investments were extremely good during the year, bringing gross income up to $15,413,218, an amount $1,559,500 in excess of the result the year previous; but the increase in payments chargeable against gross income, particularly in interest on the general account, was so great that



Pennsylvania Railroad System.

the resultant net income of $5,187,930 was only $68,289 greater than in 1903. On the P., C., C. & St. L. gross earnings were $28,532,475 in 1904, as against $28,960,821 in 1903; operating expenses were $21,365,664 as against $22,278,252; net operating earnings, after deducting rentals, were $6,626,593 as against $6,257,558; gross income was $6,806,120 as against $6,221,035, and net income was $2,920,238 as against $2,425,741.

The fact that the full report of the Pennsylvania system, giving traffic statistics in detail, is not made public for six weeks or so after the appearance of the preliminary returns, must of necessity make the present review incomplete. It is possible, however, to pick out a great number of interesting points from the operating figures at hand. In the expense column this year, on each of the lines reported, cost of conducting transportation is divided into two parts, traffic being separated from operation. This is a very interesting change and a very natural one, and tends to simplify the confusion of detail which has hitherto fallen to this account. On the Lines East, for example, conducting transportation—operation—this year cost $45,129,423, while the charge to the traffic account was $1,357,113. It seems entirely logical that the cost of getting the business should be separated from the cost of handling it, and this new traffic account should in future permit of interesting comparisons.

The general freight and passenger movement for the year on the entire system is shown below.

Traffic Statistics, Entire System.

	Freight, tons.		Ton-miles.	
	1904.	1903.	1904.	1903.
Lines East	173,002,860	185,607,463	16,570,807,393	17,154,421,789
Lines West	111,616,354	109,512,935	8,560,688,066	8,558,542,501
Total	284,619,214	295,120,398	25,131,495,459	25,712,964,290
	Passengers carried.		Passenger-miles.	
Lines East	92,077,411	96,375,145	2,081,295,039	2,082,906,133
Lines West	27,871,252	27,257,058	869,602,102	774,435,031
Total	119,948,663	123,632,203	2,950,897,141	2,857,341,164

The interesting fact here is that the passenger business on both the Lines East and the Lines West held up better than the freight business did. The fact that the Lines West gained considerably in this traffic is undoubtedly due to the St. Louis Fair, though the figures are not given in such shape that gains from this source can be picked out; but passenger traffic, when it is once well established, seems to be less susceptible to an off year than freight traffic does, and it is reasonable to expect that the good gains in passenger business which have been reported on most of the roads in the country during the last five years can be well kept up.

The following is an extract from the general remarks of President Cassatt included in the report: The tonnage shows a substantial decrease both in volume and mileage as compared with the exceptional figures of 1903, but an increase in the ton-mileage over that of 1902. The gross rate per ton per mile was the same as in 1903, but there having been a reduction in expenses, there was a slight gain in the net earnings per ton per mile. There was a lessened demand during the summer upon facilities and equipment, but the experience of the closing months showed conclusively that the heavy expenditures made for increased facilities during the past two years were more than justified. The completion of the Brilliant branch, the practical rebuilding of the Port Perry branch and the construction of its western connection with the main line at Brinton, together with the extensive additions made to the yards on the Pittsburg, Virginia & Charleston and Allegheny Valley lines, and the improvements upon the western lines in and adjacent to Allegheny City and South Pittsburg, should largely solve the problem of a free movement in the Pittsburg district and to a great extent eliminate the congestion that has heretofore prevailed therein. A large outlay was made upon the Petersburg branch, and on the Hollidaysburg yard which is now being further developed so as to fully accommodate the coal and other heavy traffic. The Fairview yard is in active service, although its track system is not fully completed, and is proving of great value in expediting the movement of tonnage. The four tracking of the Northern Central between New Cumberland and York Haven, over which the heavy tonnage eastbound from the Fairview yard passes, has been completed, and the line between York Haven and Columbia, which includes the new double-track stone bridge over the Susquehanna river at Shock's, is now in service. The present tracks east of Columbia will be used until the new freight line under construction from Columbia to Glenloch is completed. Heavy expenditures have been made between Columbia and Atglen where this road strikes the main line, and between Atglen and Parkesburg and Thorndale and Glenloch, and the work will be pushed vigorously during the current year.

The other important items of construction upon the main line during the year include extension of fourth track on the Pittsburg division, completion of the single track westbound tunnel at Gallitzin, progress in track elevation between Highspire and Harrisburg, completion of the new four-track stone bridge at Coatesville, reduction of eastbound grades on the Trenton cut-off between Glenloch and Morrisville to 15.8 ft., completion of the Newark and New Brunswick track elevations, progress on the Greenville terminal, etc.

The aggregate of these expenditures during the year upon the line between New York and Pittsburg and the branches operated in connection therewith, including $3,514,238 paid on account of the principal of car trusts, was $21,669,656, of which $12,199,495 was charged to capital account and $9,470,161 against the income for the year. The outlay upon branch and auxiliary lines operated as a part of the four grand divisions east of Erie and Pittsburg, amounted to $5,358,737, and the funds were supplied by the respective companies making the improvements, out of surplus income or from other sources.

The main items of expenditure during the current year upon the main line will be the construction of the elevated freight road along Duquesne Way, and of the new freight station at the Point in Pittsburg, the extension of the four-track system on the Monongahela division, and of second track and sidings in the coke region, the further completion of the four-track system on the Pittsburg and Middle divisions, and the work upon the new freight line between Columbia and Glenloch. Large additions will also be required to motive power and equipment; and necessary provision must be made for a permanent water supply for the main line. Serious delay has already resulted, in the handling of traffic on the Pittsburg division, from the insufficient amount and bad quality of the water that was obtainable during the recent drouth in that district. The tunnel into New York is now under active construction. Contracts have been awarded for the two tunnels under the North river between the Weehawken shaft in New Jersey and the east side of Tenth avenue, New York City, for the excavation and retaining walls for the terminal passenger station between Seventh and Ninth avenues in that city, and for the four tunnels under the East river to East avenue in Long Island City. The remaining tunnel work, under Bergen hill on the west side of the North river and in New York City east of the station, will be put under contract during the current year, as also the terminal station itself, and it is expected that the entire line will be ready for traffic in the fall of 1908.

A large power house is almost completed in Long Island City and another will be erected on the west side of the North river, which will have sufficient capacity to supply not only the power sufficient for the operation of the tunnels, but also for that portion of the Long Island Railroad system in and adjacent to the city of Brooklyn, which is now being equipped for electric service. Further large purchases have been made of real estate for the use of this line, in New York City west of Ninth avenue, and also in Long Island City and in New Jersey; while a sale of a portion of the property fronting on Eighth avenue, New York City, opposite the Terminal station, has been arranged with the United States Government for use as a general post office, the railroad company reserving the sub-surface rights.

In pursuance of the policy under which the company heretofore authorized the guaranty of $10,000,000 4 per cent. refunding bonds, issued by the Long Island Railroad Company, for the important improvements necessary for the development of its system, the Pennsylvania has guaranteed a further issue of $2,200,000 of the same securities. It has also united with the other companies which are equal owners with it in the line between Washington and Richmond, namely, the Southern, Atlantic Coast Line, Baltimore & Ohio, Chesapeake & Ohio, and Seaboard Air Line, in guaranteeing $6,500,000 of the 4 per cent. collateral trust bonds issued by the Richmond-Washington company for the purpose of double-tracking and otherwise improving that important link in the railroad communications between the North and South, over which a large volume of traffic passes to and from the Pennsylvania system. The charges to capital account during the year were as follows:

Cost of road.*	$10,757,843
Equipment: Passenger, Postal, Car Trust and other equipment	691,306
Real estate	750,345
Total charges to capital account for 1904.	$12,199,495
The increase of the capital stock during year was as follows:	
Amount issued to shareholders who had paid 75% under allotment of March 25, 1903, upon payment of remaining installment June 25, 1904.	$4,764,750
Issued for fractional scrip resulting from stock allotment and conversion of bonds	99,150
Issued in exchange for convertible bonds of Nov. 1, 1902	3,500
	$4,867,400

*Being expenditure in construction of Brilliant Branch, Duquesne Way Elevated Road, Petersburg Branch, new freight line from York Haven to Glenloch, elevated freight road through West Philadelphia, Fairview and Hollidaysburg Yards, extension of four-track system on Main Line, Gallitzin tunnel, reduction of grades on Trenton Cut-off, new shops and terminal facilities.

As advised in the call for the annual meeting, authority will be requested for an increase in the bonded indebtedness of the company. Besides making provision for the consolidated mortgage bonds, which mature

in the early summer, it will be necessary to provide the funds for a further subscription to the capital stock of the Pennsylvania Company, for that portion of the construction and equipment expenditures of the year to be charged to capital account, and for the current outlay upon the New York tunnel. Practically the entire capital stock of the Pittsburg, Virginia & Charleston, built as a feeder to the main line, has been acquired. Through its connection with the system at Pittsburg, it makes tributary thereto the large steel and coal industries of the Monongahela Valley, and it is proposed to consolidate this road with the main line.

The following table represents the totals in the general income account of all the transportation companies east and west of Pittsburg and Erie owned, operated or directly controlled by the Pennsylvania. The general results in keeping operating expenses down during a rather trying year and leaving net income practically where it was in 1903, to be subsequently increased by "other income" beyond last year's high water mark, is a triumph of good management.

	1904.	1903.
Gross earnings:		
Lines East	$156,840,441	$160,826,095
Lines West	81,401,961	81,691,662
Total	$238,242,402	$242,517,758
Operating expenses:		
Lines East	$111,113,115	$113,361,191
Lines West	60,344,578	62,018,247
Total	$171,457,694	$175,379,438
Net earnings:		
Lines East	$45,727,324	$47,464,905
Line West	21,057,383	19,673,415
Total	$66,784,708	$67,138,320
Other income:		
Lines East	$13,077,703	$12,587,813
Lines West	7,596,106	6,207,524
Total	$20,673,809	$18,795,336
Gross income:		
Lines East	$58,805,029	$60,052,717
Lines West	28,653,488	25,880,939
Total	$87,458,517	$85,933,657
Interest, rentals, taxes, dividends and extraordinary appropriations:		
Lines East	$58,961,344	$59,976,642
Lines West	25,976,331	22,889,767
Total	$84,937,675	$82,866,409
Surplus:		
Lines East	$156,316*	$76,075
Lines West	2,677,157	2,991,173
Total	$2,520,842	$3,067,247

*Deficit.

NEW PUBLICATIONS.

Reference Library of Modern Engineering Practice. Frank W. Gunsaulus, President of Armour Institute of Technology, Editor in Chief, assisted by a corps of specialists and technical experts. Chicago, 1903. American School of Correspondence of Armour Institute of Technology. Ten volumes. Size 6½ x 9½. Illustrated. Three-quarters red leather binding.

These books embody courses of the American School of Correspondence of the Armour Institute of Technology and as indicated above, were prepared some time ago. The title would be more properly descriptive if it included "Mechanical," as the subjects are all ones that should be included in a mechanical engineering course. The list is as follows: Vol. I, Mathematics; Vol. II, Mathematics, Mechanics, Heat; Vol. III, Foundry, Forge, Machine Shop; Vol. IV, Machine Design, Boilers; Vol. V, Chemistry, Metallurgy, Engines; Vol. VI, Marine and Locomotive Work; Vol. VII, Electricity: Generators, Motors; Vol. VIII, Electricity: Light, Power; Vol. IX, Heating, Ventilating, Plumbing; Vol. X, Mechanical Drawing.

The treatment of the different subjects is, of course, elementary, and to a certain extent superficial, being designed to meet the needs of that region of secondary technical education which the correspondence schools are so successfully developing. The idea in their preparation has been that many, if not all, who read them have no previous knowledge of the branches covered and may, in fact, have had most limited educational advantages. A careful and conscientious reading of these books should, however, give the student a good foundation in, and working knowledge of, the subjects treated. The entire work contains nearly 4,000 pages and is illustrated with more than 2,000 diagrams, working drawings, full-page plates and engravings of machines and tools. Each volume has at the end a comprehensive list of review questions. The typographical work is excellent, the printing being in good, clear type and the engravings well executed and of good quality. The tables of contents of the individual volumes are collected in Volume I, and Volume X contains a general index.

Poor's Railroad Manual. Appendix and Diary for 1905; containing Poor's ready reference bond list, dividends paid, annual meetings, etc. Special edition of February, 1905. Cloth, uniform in size with Poor's Manual of Railroads. Price $2.50.

This very convenient publication is devoted in part to the ready reference bond list of leading steam railroads in the United States, which aims to place in compact and conveniently tabulated form the principal facts about outstanding railroad bond issues, including amounts outstanding on or about Dec. 1, 1904, property covered, trustees, interest rate, annual charge, etc. Following this is a diary of railroad companies' annual meetings and transfer agencies, both of steam and of electric roads, and of the more important industrial corporations. There is also a list of the dividends paid by railroad companies, both steam and electric, from 1897 to 1904, inclusive, and this is similarly followed by a list of the dividends paid by industrial corporations. The book is well indexed and contains in small compass a vast amount of important matter.

TRADE CATALOGUES.

Steel Railroad Superstructure.—The American Railway Tie & Girder Co., Pittsburg, Pa., sends an illustrated pamphlet describing its steel railroad superstructure. This system is the invention of Samuel E. Duff. It consists of a continuous line of inverted trough-shaped girders combined with tie pieces and rail fastenings. One of the special claims for this system is that it provides a continuous support for the rails, thus preventing the deflections of the rails between the suspended parts of support as is the case with the common cross tie system. A complete detailed description and illustrations of this superstructure were printed in the *Railroad Gazette* March 11, 1904.

Passenger Car Ventilation.—The Automatic Ventilator Company, New York, sends a catalogue describing its automatic passenger car ventilator. This is a simple device which is fitted into the deck sashes of passenger cars. Illustrations and a description of the ventilator are given as well as illustrations of passenger and private cars in which it is used. A number of highly complimentary testimonial letters are also reproduced in the back of the pamphlet. These ventilators are being used on a number of roads and the Central Railroad of New Jersey has adopted it as its standard system of car ventilation.

Air Compressors.—The Clayton Air Compressor Works, New York, is distributing a booklet bearing the title "Compressed Facts About Compressed Air." The pamphlet opens with a resume of the points to be considered in buying an air compressor of medium capacity. This is followed by brief chapters devoted to the following topics: "Economy of Compressed Air," "Features of a Money-Saving Air Compressor," "How These Features are Combined in a Good and Medium-Priced Machine," "Method of Driving Air Compressors," and "Some of the Uses of Compressed Air." Under the last heading are enumerated 139 distinct applications of compressed air. Illustrations showing various types of compressors and their parts are distributed throughout the pamphlet.

Drill Grinders.—Catalogue "C" is being distributed by the Washburn shops of the Worcester Polytechnic Institute, Worcester, Mass. Illustrations and descriptions of various designs of grinders made by these shops are given. Including both dry and wet machines for floor and bench use. The machines are designed for grinding both right-hand and left-hand drills, and can be driven either by electricity, belt or air. A short article on the grinding of drills is also given.

Wattmeters and How to Read Them.—This is the self-explanatory title of a small pamphlet which is being distributed by the Westinghouse Electric & Manufacturing Co., Pittsburg, Pa. It contains directions for reading the Westinghouse meter and a brief explanation of what it is and how it operates.

Legal Decisions in February.

The following abstracts embrace the principal legal decisions in railroad cases during February, handed down by the United States Supreme Court and by the other Federal courts:

Rentals as Claim in Receivership.—Where the lessee of a road operated the road without payment of rentals to his lessor, a claim for such rentals cannot be established as an equitable lien upon funds arising from earnings during the receivership had in a suit to which the lessor was not a party. In no event can a lease which is void as contrary to public policy be the foundation of any recovery of rentals. (Cir. Ct. App.) Cox vs. Terre Haute & Indianapolis Railroad Company, 133 Fed. Rep., 371.

Automatic Coupler Act.—The Federal automatic coupler act prohibiting carriers from moving cars engaged in interstate commerce unless equipped with automatic couplers applies to locomotives and dining cars and is violated where the engine and dining car are equipped with automatic couplers of different types which will not couple and uncouple automatically. The fact that the dining car is not engaged in interstate commerce at the moment of coupling does not exempt it from the operation of the law. (Sup. Ct. U. S.) Johnson vs. Southern Pacific Company, 25, Sup. Ct., Rep. 158.

Injuries from Defect in Track.—When a fireman was killed by the derailment of his engine directly caused by a defect in the track, it may not be urged as a defense in an action for his death that the engineer, a fellow servant, was running the engine at an excessive rate of speed. (Cir. Ct. App.) Shugart vs. Atlanta, K. & T. Railway Co., 133 Fed. Rep., 505.

Validity of Ohio Railroad Employee's Law.—The Ohio law modifying the employer's liability as formerly existing and imposing on railroad companies a liability for injuries caused to an inferior in one branch of the service by the negligence of a superior in another branch of the service is a legitimate exercise of legislative power and not open to the objection that it operates as a denial of

the equal protection of the laws to railroad companies. (Cir. Ct. App.) Kane vs. Erie Railroad Co., 133 Fed. Rep., 681.

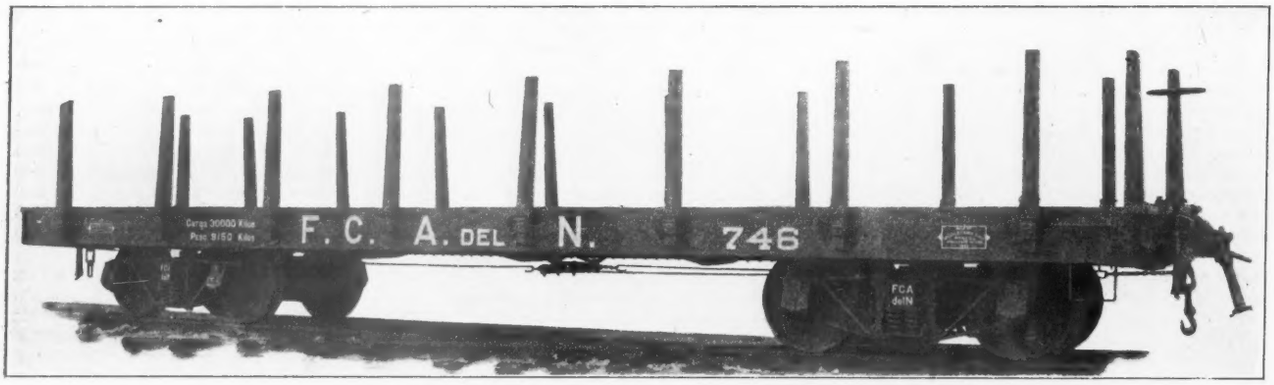
Seizure of Intoxicating Liquors in Possession of Express Company.—A state is without power under its excise laws to seize intoxicating liquors in possession of an express company and shipped from another state c.o.d., and an attempt to do so will infringe the commerce clause of the Federal constitution. (Sup. Ct. U. S.) American Express Company vs. State of Iowa, 25 Sup. Ct. Rep. 182.

Dangerous Structures in Close Proximity to Tracks.—A railroad company cannot be said, as a matter of law, to have adequately provided for the safety of its switchmen where it has so located its scales that a switchman incumbered with a lantern has a space of only two feet to pass between the scales and the sides of freight cars on an adjacent track. (Sup. Ct. U. S.) Texas & Pacific Railway Co. vs. Swearingen, 26 Sup. Ct. Rep. 164.

Georgia Connecting Carrier Act Unconstitutional.—The Georgia statute requiring a carrier to trace the location of a loss or injury to freight received from a connecting carrier to free itself from liability therefor violates the commerce clause of the Federal constitution when applied to an interstate shipment. (Sup. Ct. U. S.) Central of Georgia Railway Company vs. Murphy, 25 Sup. Ct. Rep. 218.

Contribution Between Carriers.—A terminal carrier whose negligence toward an employee was caused by a failure to inspect cars accepted from a prior carrier cannot enforce contribution or recover indemnity from such prior carrier because of a like neglect of duty on its part. (Sup. Ct. U. S.) Union Stockyards Company vs. Chicago, Burlington & Quincy Railroad Co., 25 Sup. Ct. Rep. 220.

Assumption of Risks from Frogs.—Where a railroad company maintained numerous spring rail frogs with the necessary excavations under the spring rails in the railroad yards, a switchman working in the yards for six months before receiving an injury will be held to have known the dangers and assumed the risks of injury from such frogs. (Cir. Ct. App.) Riley vs. Louisville & Nashville Railroad Company, 133 Fed. Rep. 904.



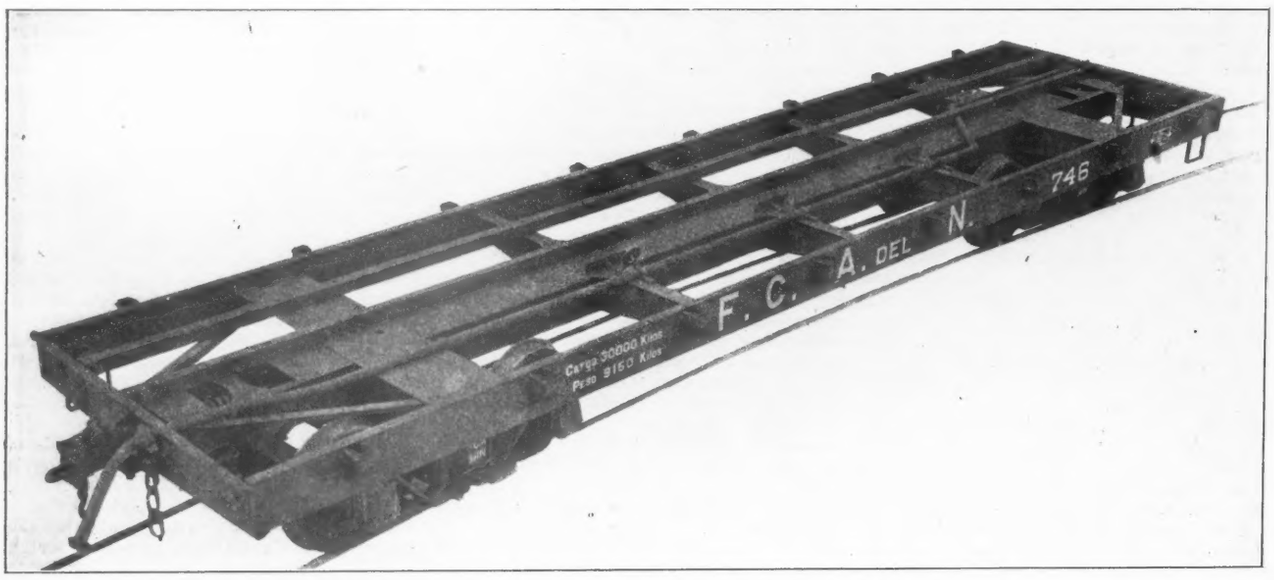
Flat Car for the Argentine Government Railways.

Flat Cars for the Argentine Government Railways.

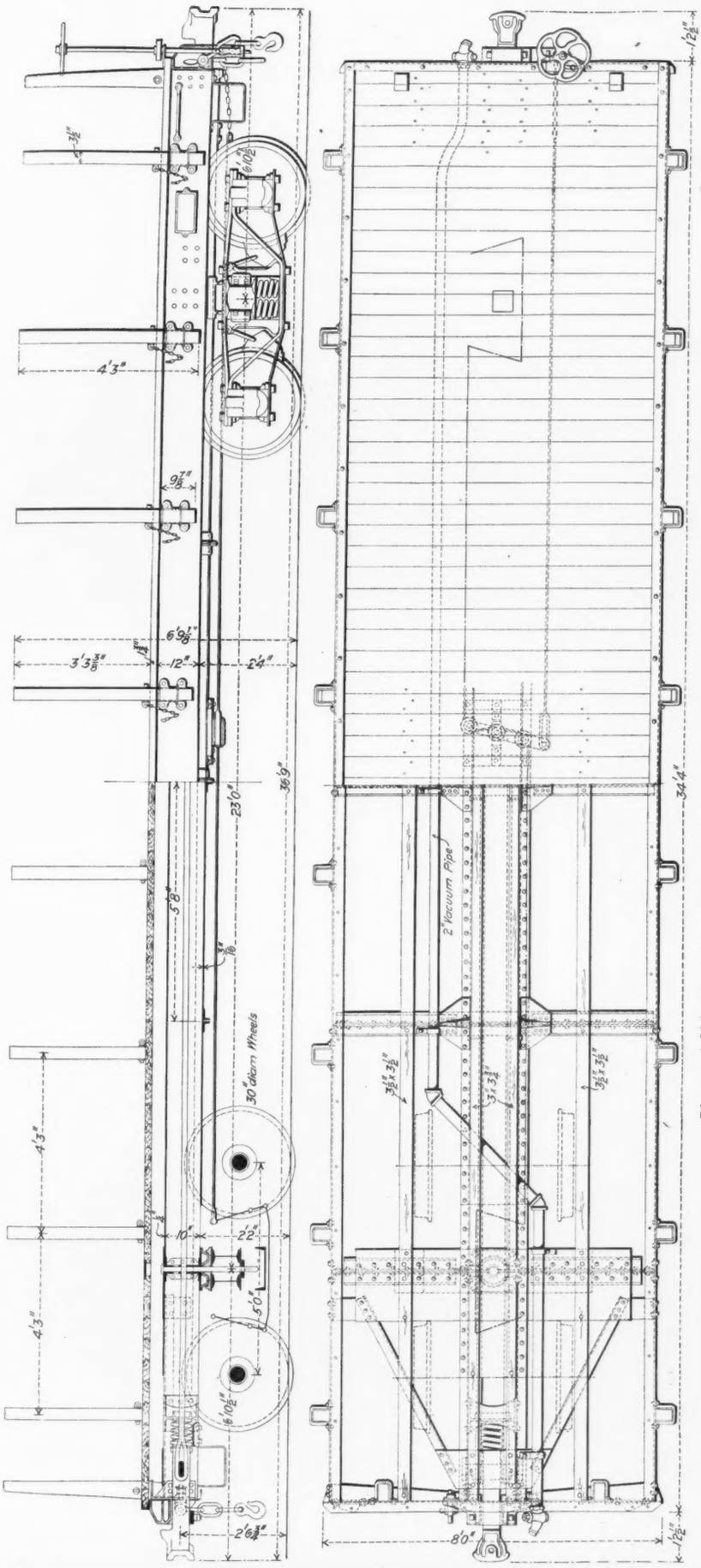
The Argentine Government operates about 950 miles of state railways of one meter gage in the northern and northwestern provinces of the Argentine Republic which form a part of the extensive network of roads having Buenos Ayres as its center. Some time ago plans were made for important extensions of the Government lines and contracts were let to Toledo, Maraini & Co., of Buenos Ayres, for carrying out this work. The two most important lines to be built are from Serrezuela, on the North Argentine Railroad, west to a connection with the Argentine Great Western at San Juan, a distance of about 240 miles, and an extension of the North Argentine Railroad from La Rioja to Andalgala with branches, a total distance of about 270 miles. When completed the San Juan extension will give a connection from the northern provinces of Argentine to the Transandine Railway into Valparaiso, Chile.

Many features of American practice are being introduced in the Argentine railroads and when the equipment and rolling stock for these new extensions was ordered the Middletown Car Works, Middletown, Pa., received the contract for all of the cars for these lines, amounting in all to 615 cars. For the extension to San Juan there will be supplied 150 box cars, 50 gondolas, 100 flat cars, 50 stock cars and 25 tank cars. For the Andalgala extension 100 box cars, 50 gondolas, 50 flat cars and 40 stock cars have been ordered. All of these cars will have structural steel underframes and are to be of 30,000 kilos, or 66,000 lbs. capacity. The details of the designs were left with the builders and Mr. George I. King, Vice-President and General Manager of the Middletown Car Works, prepared the designs to suit the special conditions of service and shipment embodying in them many of the features which have characterized other cars turned out at these works.

The first of the flat cars has now been completed and the accompanying illustrations show the principal features of their construction. They are 34 ft. 4 in. long over floor and 8 ft. 8¼ in. wide over all, and are mounted on diamond arch bar trucks of one meter gage. The underframe is designed to

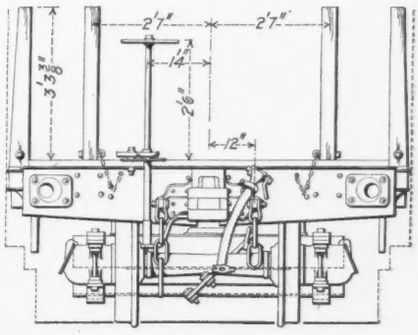


Underframe of Flat Car for Argentine Government Railways.



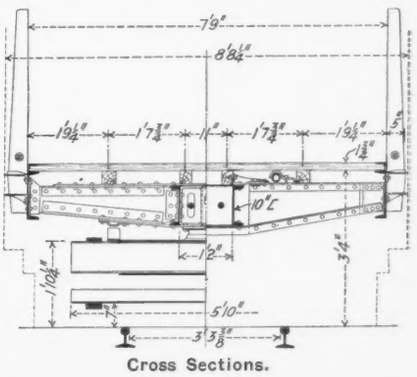
Plan and Side Elevation of 33-ton Flat Car for Argentine Government Railways.

support a uniformly distributed load of 95,000 lbs., including the dead load, with a deflection at the center of ½ in., without exceeding a maximum fiber stress of 16,000 lbs. in the tension and compression flanges of the sills. The center sills are 10-in., 15-lb. channels spaced 14 in. apart forming a box girder with the top and bottom cover plates, which are 19 in. x ¼ in. and 19 in. x $^{3}/_{16}$ in. respectively, and which extend the entire distance between bolsters. The side sills are 12-in., 20.5-lb. channels supported by the end sills and bolsters, and further by six intermediate cross frames. These cross frames are built up from a $^{3}/_{16}$-in. plate, two 2½-in. x 2-in. x ¼-in. top flange angles and



End Elevation.

two 3-in. x 2-in. x ¼-in. bottom flange angles. They are built around the center sills and are not connected by any bolts or rivets to the webs of sills but are fastened to the top and bottom flanges. The bottom angles are continuous under the sills but the top angles are riveted to the under side of a projecting lug or bracket riveted to the top flange of the sills. This construction was employed to facilitate repairs since it would be impossible to get at the riveted connections if made through the webs of the sills on account of the top and bottom cover plates which box up the sills for the entire distance between bolsters. The connection to the side sills is formed by bending the end of the



Cross Sections.

web plate of the cross frame at right angles and riveting with two rivets through the web of the channel. The bolsters are of somewhat similar though heavier construction, with an additional top and bottom cover plate extending over and under the center sills. The web plate of the bolsters is connected with the side and center sills with two bent plates riveted to the channel webs. The end sills are of the Z-bar type patented by Mr. King. They are bent from $^{3}/_{16}$-in. plate and have the top flange projecting out and the bottom flange projecting in. Heavy and substantial push pole pockets drawbar striking plates are riveted to the outside face.

All of the cars are fitted with cast-steel link and pin drawbars with 5-in. x 5-in. shanks furnished by the National Malleable

Castings Company, Sharon, Pa., and have continuous draft gear attachments. A heavy malleable iron filler block is riveted between the center sills having a thimble for the spring on its front face. The spring used is a standard 6¼-in. x 8-in. M. C. B. draft spring. The two draft rods are 1⅜ in. in diameter, with the ends forged to take the 4½-in. x 1⅛-in. draft key. Slots are cut in the webs of the center sills for the draft key to slide in and additional bearing surface for the key is provided for by riveting two short pieces of light angle iron on the outside of the webs of the sills with the top flange flush with the edge of the slot. The draft rods pass back through holes in the filler casting and are entirely enclosed in the box column of the center sills. Safety chains are attached to all cars by means of eye bolts passing through the drawbar striking plate and end sill close to the center sill connections.

The floor of the car is laid with 1¾-in. boards secured to four 3½-in. x 3½-in. nailing strips of long leaf southern pine and resting on the outside edges directly on the top flange of the side sills. The nailing strips are bolted with ½-in. carriage bolts to the cross members of the underframe, and the floor boards are screwed down, no nails being used. A 2½-in. x 1¾-in. angle is fastened along the sides and ends of the car with bolts passing through the flanges of the sills and this effectually protects the floor boards as well as providing a neat finish. The side stakes are 3½-in. x 5-in. at the bottom, and are secured by malleable iron stake pockets similar to the form recommended by the Master Car Builders' Association. These pockets and all other malleable castings were furnished by the National Malleable Castings Company, Toledo, Ohio.

Only the stock and tank cars will be fitted with automatic vacuum brakes, but all of the other cars will be piped and hose connections applied. They will be braked with hand-brakes working on all eight wheels and applied by a hand-brake shaft at one end of the car through a single pivoted lever.

The trucks on which these cars are mounted are of the diamond arch bar type, having arch bars 4 in. x 1 in. and tie bars 4 in. x ½ in. A 12-in., 20.5-lb. channel is used for the spring plank, and the bolster has an 8-in. box girder section with 12-in. x ¼-in. top and bottom cover plates closely riveted to the flanges. The axles are Carnegie steel with 4¼-in. x 8-in. journals, and all other dimensions M. C. B. standard except, of course, the length which is shortened for one meter gage. The wheels are chilled cast-iron, 30 in. in diameter, and weigh 500 lbs.; they were furnished by the Ramapo Foundry & Wheel Works. All parts of the journals are M. C. B. standard for 4¼-in. x 8-in. journals. The brake-beams were furnished by the Pennsylvania Brake-Beam Co., and the journal bearings by the Ajax Metal Co.

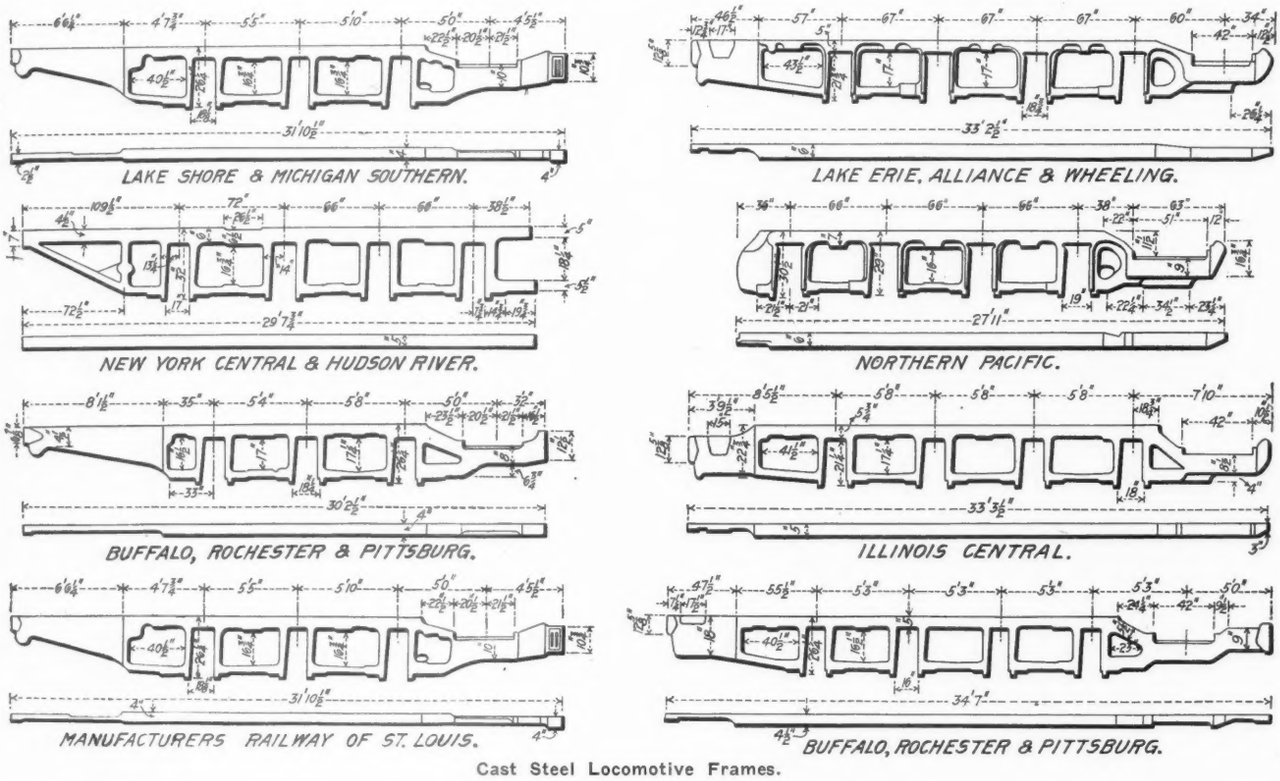
The flat cars weigh complete 9,150 kilos, or about 20,135 lbs. Inasmuch as the first car turned out was loaded with a test load of 88,000 lbs. of pig iron without exceeding ½ in. deflection at the center this is a low weight for the capacity.

In designing these cars special attention was paid to the details with a view of facilitating their prompt delivery and easy erection after shipment. Wherever possible the rivet spacing has been made uniform from end to end of any single piece so that automatic machinery could be used in punching the holes. Rivets have been used in ample abundance at all connections. The erection of these cars at the Middletown Car Works is under the general supervision of Manuel Elordi, technical inspector in the United States for the Argentine Ministry of Public Works. All of the cars will be shipped from the port of New York in steamers of the Houston Line, direct to Rosario, where they will be assembled. The steel underframes are riveted up complete in one piece, while the stakes, floors and miscellaneous iron parts are boxed or crated. The wheels and axles are shipped mounted but separate from the trucks.

The order for these cars was placed through William B. Deming, 17 State street, New York, who is export manager for the Middletown Car Works. We are indebted to Mr. George I. King, Vice-President and General Manager of that company, for the drawings and information.

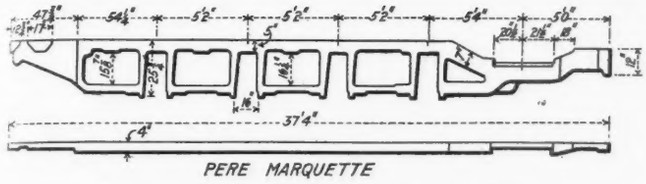
Cast Steel Locomotive Frames.

Cast steel locomotive frames have been made for a number of years but with most success during the last year or two. Formerly frames were made in such a manner that they had many shrinkage cracks in them, and when cracks did not develop the shrinkage strain on the castings was so great that the frames would not stand the severe usage required of them. The difficulties presented to the practical railroad man from this cause were so great that many deemed it risky to abandon the wrought iron frame for that of cast steel, and even to-day some object strongly to the cast steel frame and are averse to its use on their locomotives. By improved methods of manufacture to prevent shrinkage cracks, use of the very best grade of low phosphorus acid open hearth steel, and by thoroughly annealing the castings, the above objections have, no doubt, been overcome.

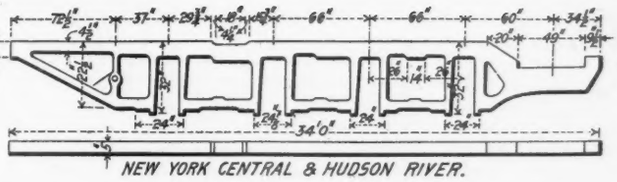

LAKE SHORE & MICHIGAN SOUTHERN.
LAKE ERIE, ALLIANCE & WHEELING.
NEW YORK CENTRAL & HUDSON RIVER.
NORTHERN PACIFIC.
BUFFALO, ROCHESTER & PITTSBURG.
ILLINOIS CENTRAL.
MANUFACTURERS RAILWAY OF ST. LOUIS.
BUFFALO, ROCHESTER & PITTSBURG.

Cast Steel Locomotive Frames.

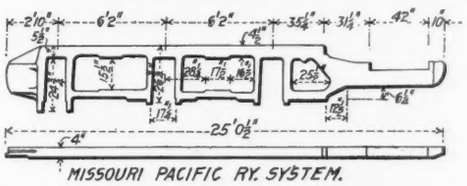
The American Railway Master Mechanics' Association in June, 1903, discussed the matter and appointed the following committee: T. S. Lloyd, S. M. P., D., L. & W.; S. Higgins, S. M. P., Southern; A. Lovell, S. M. P., Santa Fe; S. M. Vauclain, Gen. Mgr., Baldwin Locomotive Works; J. E. Sague, Mech. Engr., American Locomotive Company; R. Wells, President, Rogers Locomotive Works. This committee was to thoroughly investigate the relative merits of forged iron and cast steel locomotive frames and report at the convention one year later. Three of these gentlemen are manufacturers of forged iron frames, and three of them are practical railroad men. They held a number of meetings and asked several steel castings manufacturers to meet with them. They made exhaustive chemical and microscopical tests,



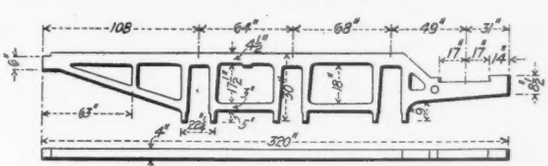
PERE MARQUETTE



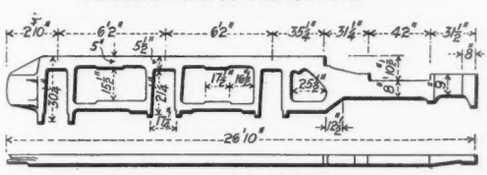
NEW YORK CENTRAL & HUDSON RIVER.



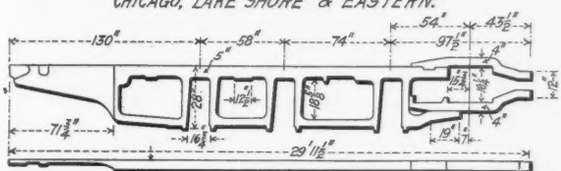
MISSOURI PACIFIC RY. SYSTEM.



CHICAGO, LAKE SHORE & EASTERN.



ST. LOUIS & SANFRANCISCO.



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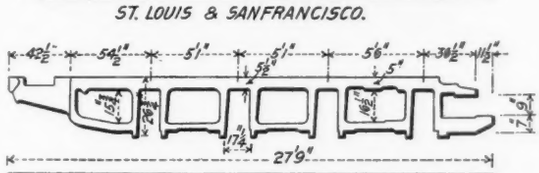

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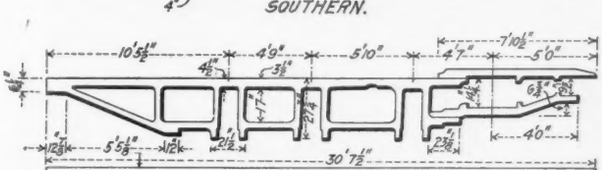

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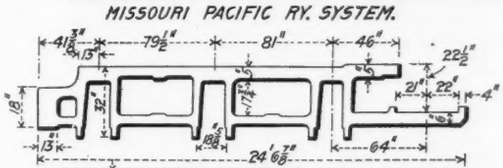

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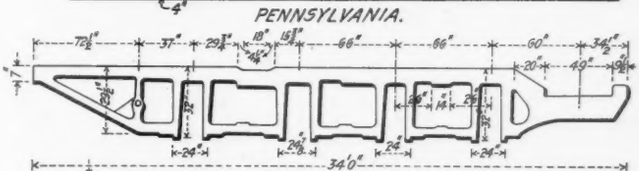

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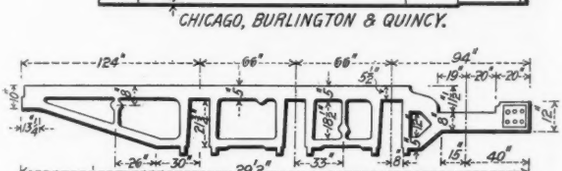

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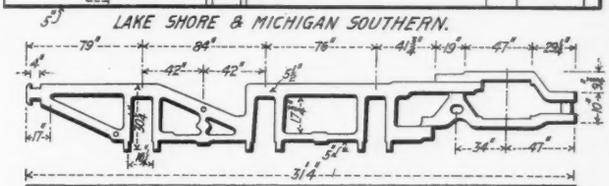

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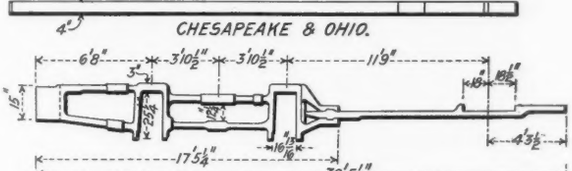

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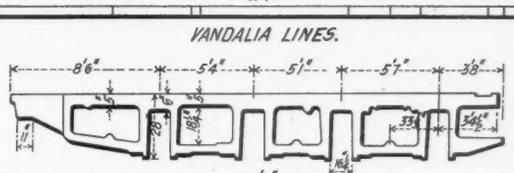
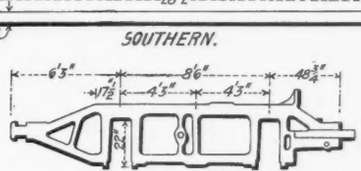


SOUTHERN.

PENNSYLVANIA.



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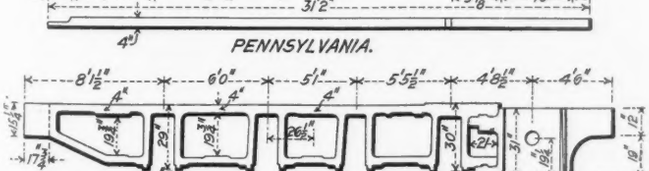

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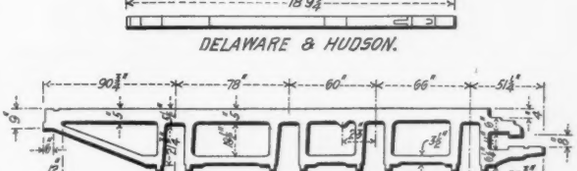

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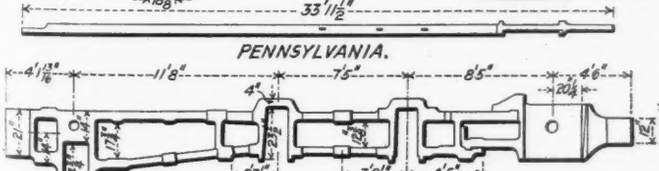


PENNSYLVANIA.

CHICAGO, LAKE SHORE & EASTERN.

Cast Steel Locomotive Frames.

and asked all the principal railroad companies in the United States and Canada for an expression as to the relative merits of forged iron and cast steel frames. Of the 41 railroads reporting, 15 with 5,613 locomotives favored iron frames. Of these 15 only four used any steel frames. Eighteen roads with 11,512 locomotives favored steel frames, and eight roads with 4,015 locomotives expressed no preference.

The committee's report to the convention covers 29 pages and their summary is as follows: "Your committee considers cast steel a better material for locomotive frames than wrought iron. The tensile strength of steel suitable for frames is about 75,000 lbs. per sq. in., as compared with 53,000 to 54,000 lbs. per sq. in. for the best hammered iron. The cast steel frame is practically homogeneous—that is to say, there are no welds, and it is of a uniform texture throughout its entire length. The number of projections required for the reception of brake work, tumbling shafts, rocker pins, etc., seriously complicates the production of modern frames in hammered iron, whereas the reverse is true in the manufacture of cast steel frames. Generally speaking, steel is intrinsically superior to wrought iron, and all the difficulties experienced with cast steel are mainly chargeable to either design or method of manufacture and not to the steel per se. To abandon steel for such reasons is a reflection on our engineering skill and manufacturing abilities; therefore we should devote our time and skill to the improvement of the art and thereby approximate more nearly the possible theoretical advantages."

The Union Steel Casting Company of Pittsburg, Pa., which makes a specialty of locomotive castings, has sent to the railroads a series of blue-prints, which we reproduce, showing different styles of cast steel locomotive frames made by them. This company makes frames under a patented process, whereby in baking the moulds the face of the mould is thoroughly dried while the major portion of the sand is left moist and easily crumbles away in response to the strain produced by the shrinkage in the casting while cooling. When the moulds are baked in an oven in the usual way the sand becomes very hard and will not respond to the shrinkage strain of the steel, and the casting breaks or is severely strained instead of the sand yielding. By this improved method the advantage of a perfectly dry face of the mould is secured, and the sand will crumble away when the shrinkage strain sets in, leaving a perfect casting.

Standard-Code Rules.

Should not there be a Revision of those for Single Track?

BY H. W. FORMAN,
Author of "Rights of Trains on Single Track."

I have a good friend named Bill who has a pretty level head on his shoulders, even if, once upon a time, he did undertake to demonstrate that seven passenger trains could be run east and six west daily without deadheading a crew and engine west every day. There are two excellent things about Bill: he is fair and he understands the English language. But, like many others, he cannot read into a rule something that is meant, but not expressed. Whenever I get into a difficulty I always look him up. A few days ago I was pondering over Rule 4 B and was floundering in pretty deep water when I remembered Bill and decided to refer the entire proposition to him. "Why," said he, "it is only necessary to read 'date' into that rule to make it so clear that a child who has never seen a book of rules can understand it." He was persuaded to draft such a rule for me, and we then went over it very carefully, with the result that now some of Bill's trains are dead at blind sidings, or in doubt about their authority to proceed. You see, Bill had been won over to the date theory by reading some of the late magazine articles, without having taken the precaution to verify certain theories by actually checking them against the trains on a time-table. Haven't seen much of Bill lately, until this morning he dropped in, fresh from having tried to "show" some switchmen, and blurted out, "A rule which needs to be ruled upon, or an explanation that has to be explained, in order to get at its exact meaning or application, is a delusion and a snare and should be amended." I then asked him what "train order" meant as referred to in Rule 82, and if he thought an extra could be regarded as a classified train. He replied that train order, as used in Rule 82, meant that the despatcher could instruct the train which had lost right and class to resume its schedule, or could run any other train on that schedule, in cases where a train had two times at a station and arrived dead, but still had life on its leaving time; and that if extras are not classified trains there are technical collisions in the standard code rules. He did not explain how a train which is not represented on a time-table could be classified. That is the trouble; one must read into some parts of the code certain unwarranted understandings in order to make the rules practicable and workable. A few more words added here and there, with slight changes of phraseology, would clear up a great deal of doubt. For instance, by "train order" in Rule 82 it must be understood that the schedule is forever lost, and the train which becomes 12 hours behind such schedule time must thereafter be run extra, or be instructed to assume some other existing schedule. It cannot be ordered to again run on its schedule, even though not yet 12 hours late by its leaving time. Nor can the unexpired part of such schedule be given to any other train.

There would, of course, be some opposition to another revision of the rules on account of the labor involved in instilling into the minds of employees the new meanings, but this should not deter those who are devoting their time to securing for American railroads the best rules that can be devised. Different standards of engines and cars are constantly being adopted at very great cost, because they are known to be better than the former patterns; why not look at a revision of the rules in the same light? Ingenuity and industry combined having evolved something better, it should be accepted and put into effect without hesitation. It is no reflection on past achievement to improve upon it whenever improvement can be made. Willingness of officials to change their rules is not bothering me nearly so much as the temper of the editor of the *Railroad Gazette;* whether or not he will allow me to again break into print at the great length necessary to discuss such a hoary subject; there's the rub!

Have you dabbled much in rule making? Ever work on a rule until midnight and then crawl into bed well satisfied with yourself and with a firm conviction that you had turned out a daisy; a rule which fully solved the problem, and which would be invulnerable under the most severe tests, only to awaken with a start, about 3 a.m., with some new thought that showed very clearly that there could be a collision under it? I feel sure that the Train Rule Committee of the American Railway Association will thank anyone very kindly who will send them a perfect rule 4 B; one that will fully and clearly provide for every problem incident to time-table changes. The despatchers in convention at St. Louis last year had nothing new to offer, except in the wording, in which I fully concur. Bill is in the other room now wrestling with the subject, and I hear ejaculations that might not look pretty in print, and things dropping off his desk onto the floor, from which circumstances I fancy that he is not meeting with a satisfactory degree of success. If you decide to draft a rule, I beg of you to hold it several days and think it over; also, see what the switchmen and section foremen have to say about it. Remember the old rule which forbade section men from working until all sections of a train had passed; and how the despatcher gave all the trackmen on that district a holiday by running sections all day long. It was afterward explained that this was not the understanding that the makers of the rule intended should prevail. Bill says he does not know what was in their minds, but he knows what the rule said. Bill is very headstrong; he ought to have known that the company wanted the men to keep at work. Possibly he may have been one of the sectionmen and interpreted the rule favorably for himself. Self interest sometimes makes a difference.

Instead of devoting all of our time to and showering so many execrations upon Rule 4 B, which at present contains a principle sufficiently broad to cover nearly every time-table change, and which I fear can never be so framed that it will clearly define what shall be understood in every instance, time can be more profitably spent in discussing and changing some of the other rules. More thought should be given to practicability and less to ancient theories which are often only a hindrance to the movement of trains; which do not insure greater safety, but do take up the time of busy despatchers unnecessarily. For instance, requiring the same crew to receive the annulment of a regular train when they start out on a new trip, after having received such annulment on a previous trip; giving one extra a train order to pass another; requiring trains of the same class to receive a train order to change their relative positions on the road; forbidding inferior freight trains from moving ahead of superior freights, without a train order; not allowing an order to be given authorizing an inferior train to run ahead of a superior train "until overtaken"; nor one instructing a regular train to run on a later schedule than its time-table schedule, or to order it to wait at several different stations, until certain times, without specifying the trains it shall wait for. It is far better practice and safer to allow freights to move ahead of each other by rule. When the movement is authorized by train order men are not so painstaking in protecting the rear of their trains. The despatcher may be depended upon to get the slow freights out of the way of the more important ones at the proper time.

Study Form H and see what you can make out of it: When an extra train receives a copy of a work train's working order, as required by the rule, it in no way acts as a preventive of a collision if such working order states that the work train may work within certain limits without protecting against extra trains. The extra passing over such limits must, in addition, be given an order to protect against the work train; such protecting order is of itself full notice of the work train, and to have to also issue a copy of the working order is just so much extra work for a despatcher without adding one iota of safety. The standard double track working order requires a work train to protect its rear at all times, unless instructed not to do so; but the single track

order, similarly worded, allows a work train to work on single track disregarding all extra trains. Thus, on roads having short pieces of double track, the work train crew must keep in mind two distinct and opposite principles in passing from double to single track within its working limits. It would be difficult to find a more dangerous practice permitted under rules said to have been framed with the view of securing for railroads a greater degree of safety. Still, the despatchers in convention said, "In our opinion, the Standard Code Form H calls for no change."

I do not consider it good and safe practice to allow a work train to occupy the main track on a road where extras may have to be run at any time, without instructing it by rule or train order to protect itself at all times against extra trains. Work trains generally have from 30 to 100 men exposed to danger and are not always entered on the despatcher's sheet in the same conspicuous manner that other extra trains are; and they are more apt to be overlooked than any other extra because they may move in two directions. Rules governing them should be framed with this view. Make an exception when they are not required to protect, rather than to allow despatchers to depend upon their memories to instruct extra trains running over the work train's limits to flag against it, since, by the present code rules, a copy of the working order, stating that the work extra is not protecting, is not of itself regarded as instructions to extra trains receiving it to protect against a work extra.

I was mildly surprised at a paragraph added to Rule 99 by one of the large roads in this country which, only last August, got out a brand new book of rules, in which may be found, substantially, the Revised Code. It reads: "If an approaching train is in sight, or if a passenger train is due within 10 minutes, he (the flagman) must remain until it has been stopped." This is simply another illustration of the folly of inserting rules in a book which cannot in all cases be lived up to without unnecessary detention to trains. The passenger train referred to may meet with delay and not come along for several hours. The freight train is then left with the alternative of waiting some time for its flagman to come in, or proceeding with but one brakeman, an unsafe thing to do. It will no doubt be explained that the flagman must use judgment, and if the passenger train does not arrive within 10 minutes or so he may go toward his train. But with such qualification the rule does not mean what it says; it invites employees to disregard it and that leads to disregard of others which it may seem also unnecessary to strictly observe, because sometimes impracticable.

Having pointed out a few shortcomings and objectionable features to assist in making my object clear to the reader, I will now take up in their turn a number of code rules and forms which seem to be in need of revision to better facilitate the movement of trains and to secure common understanding.

"Form of order putting rules in effect." The word "order," being a train-order term, should be eliminated. The caption could be changed to read: "Form for putting rules in effect."

Rule *A*, of general rules, reads: "Employees whose duties are prescribed by these rules must be furnished a copy, which they shall keep at hand while on duty." This rule is inconsistent as it requires a newly-employed person to provide himself with something that he may not know is in existence. The rule does not mean that employees shall carry the book on their persons, but a book should always be at hand in telegraph offices, on engines and in cabooses. Employees are sometimes too careful of their books; I have known men to be in possession of a book for several years without hardly soiling it, while the copy of their "Agreement" or "Schedule," was found to have been so badly worn that it needed a new binding.

DEFINITIONS.

It may be said of the definitions, that they are not logically arranged. There must first be a main track, then a siding, and then a station and a fixed signal, before a "train" should be created.

"*Train.*—An engine, or more than one engine coupled, with or without cars, displaying markers; and the men in responsible charge."

How often an engine and cars displaying markers is found on a siding, but no one at hand to identify it. From the despatcher's standpoint the men in charge of a train are a necessary part of it and of the definition.

"*Regular Train.*—A train authorized by a time-table schedule. It may consist of sections."

"*Superior Train.*—A train having precedence over another train. A train may be made superior to another train by right, class or direction."

The present definition for a superior train appears to be wrong, and it should read as above if for no other reason than to stop contention.

"Right, class or direction" has taken such firm hold of the mind that one feels reluctant to ask that it be changed; nevertheless, it may be contended with some force that when a train loses class it still has some part of its life left to it, since "schedule" embraces more than "class." Moreover, when one train is scheduled to pass another of the same class, it does not get its authority to do so by right, class or direction, but by schedule. I shall propose schedule, instead of class, as in some cases conducive to greater clearness of thought.

Should not there be a definition for precedence, following that for "train of superior direction?"

"*Precedence.*—Authority by right, schedule or direction to hold the main track over, or to move ahead of or against another train."

RULES FOR SINGLE TRACK.

Standard Time.—I regard it as absolutely necessary that Rule 2 should require operators to have watches that have been certified to by an inspector, and recommend that the Train Rule Committee so instruct, regardless of the fact that a few may offer objections. On roads using the "Middle Order," (and this method of handling trains is becoming more and more popular) operators are often alone entrusted with orders restricting superior trains, without such orders also being addressed to the superior trains before they reach their stations; and it is highly important that they have the correct time, to prevent their changing their order signals to "proceed" after a certain time has elapsed. Also for the further good reason that operators are allowed to destroy an order addressed to a train after it becomes 12 hours late; trains often run very close to this limit of time. It is now almost as necessary that firemen, flagmen and brakemen also have watches which are known to be reliable, as they assist their enginemen and conductors in the execution of orders.

Cannot the allowable variation of 30 seconds per week be cut down to 15 seconds? I do not think it necessary, nor is it safe, to allow men to use a watch which may vary this much in seven days. Rule 88 allows the inferior train of the same class to use up to the last second of time to clear the superior train at a meeting point. If the watch of the waiting engineman is 30 seconds fast, and that of the engineman on the approaching train is 30 seconds slow, there is a difference of one minute which may cause, and has caused, the train clearing to be "side swiped"; or it has resulted in the two trains meeting on the main track beyond the siding. I am in favor of providing a two minute clearance between opposing trains of the same class, but shall not recommend it, for the reason that very few operating officials will endorse such a view. In practice, it makes very little difference to men what the rules say shall be the arbitrary clearance; if they can scratch in they will go. But, at the same time, I dislike to see rules which are to govern them so loosely drawn, and believe that to require a few minutes' clearance between all opposing trains would prevent men from taking so many foolhardy chances.

A standard form for registering the time that watches are compared with a standard clock should be made a part of the code. The common practice of providing a column in train registers for this purpose is not at all satisfactory. This form should be sent to the superintendent daily and checked against the train sheet, to see if all conductors and enginemen are respecting Rule 3.

(*To be continued.*)

Cargo and Intermediate Steamers.*

The following extracts from Mr. De Russett's paper deal with recent developments in Great Britain in building the two types of steamships specified in the title. The great progrss which has been made during the past few years, especially as regards increases in size and in economy of working, makes it important that ship building and the economics of ocean carrying should be periodically reviewed.

TYPE.

The shelter-deck type is still in favor for the largest cargo and intermediate steamers, owing to the superior seaworthiness arising from large surplus buoyancy, and also on account of the covered-in shelters and relatively small registered tonnage.

Development has taken place also in the design of the single-deck vessel, in which there is but one deck, with holds clear, or practically clear, of beams and pillars; and the size of such vessels has been increased. This arrangement is specially suitable for the carriage of cargoes such as coal, timber, grain, ores, etc., which can bear superincumbent weights. So skilfully have these structures been designed, that beams and pillars have been entirely dispensed with in the holds of steamers of up to 5,000 tons deadweight; while in each of the midship holds of the largest vessels of this class, carrying upward of 10,000 tons, only two beams, connected to web frames and supported by wing pillars and deck-girders, have been found to be necessary for giving the structure due strength, with the addition of a bulkhead.

The turret-steamer Grängesberg, built in 1903 by Messrs. Wm. Doxford and Sons, is the largest single-decker in existence. She is 440 ft. long, 62-ft. beam and 29 ft. deep in the hold, and is reputed to carry about 10,000 tons of ore on the light draught of 22 ft. 6 in. It is difficult to foresee what size may yet be reached in vessels having but one deck.

Vessels specially constructed for carrying oil in bulk have advanced in size even more rapidly than those of the foregoing types. In 1899, oil-steamers carrying 6,000 tons were considered large; but the Narragansett, built in 1903, is 512 ft. long, 63 ft. 4 in. beam and 34 ft. 6 in. deep, and carries 11,000 tons of oil and 1,500 tons of either oil or coal fuel. The newer oil vessels are also designed for carrying general cargoes, and are fitted with all necessary appliances for this purpose. As they are divided into numerous compartments by oil-tight bulkheads and trunks, they are probably the safest vessels afloat, being practically unsinkable.

Of late years large vessels have been built to

*From a paper by Edwin W. De Rusett, printed in *The Proceedings of the Institution of Civil Engineers*, London.

carry part cargoes of fruit from Costa Rica and West Indian ports to the United Kingdom, but more recently the whole space available for cargo has been devoted to fruit. As an example of this latest type of fruit-steamer may be cited the Matina, 350 ft. by 46 ft. by 32 ft., moulded, in which about 46,000 bunches of bananas will be carried in insulated chambers to home ports, at 12½ knots per hour. The fruit will be preserved by currents of air cooled by CO_2 refrigerating machines. (An extended discussion of the fruit trade will be found in the *Railroad Gazette*, Aug. 5, 1904.)

While cargo-vessels have thus been much increased in size and in carrying-power, still greater developments have taken place in intermediate steamers, which have now attained colossal dimensions. In 1899 the Cunard liners Ivernia and Saxonia were built. They have each a tonnage of about 14,200 tons gross, and carry about 12,900 tons dead-weight on 32 ft. draught. They are now fitted so as to carry about 2,500 first, second and third-class passengers, and have actually carried at one time a total of 2,347, besides a crew of about 300 all told. Since they were in commission, the White Star Suevic, of 12,500 tons gross, has been built, carrying nearly 450 passengers, besides 12,000 tons of cargo, and coal sufficient for the whole voyage to Australia via the Cape, at 13 knots per hour. She has been followed by other vessels of the same class and of still larger tonnage, dimensions and capacity, culminating in the Celtic and Cedric, each of over 20,000 tons gross tonnage; and quite recently, the Baltic of 24,000 tons gross—the largest vessel ever built. Her capacity for measurement cargo is about 28,000 tons. She accommodates nearly 3,000 passengers, besides having space for a crew of about 350. All these vessels have twin screws and balanced engines.

In addition to the foregoing typical vessels, the Allan Line is adding two intermediate steamers of about 12,000 tons gross, which will be fitted with Parsons turbine-engines. The boilers will afford steam for 11,000 h.p., which, it is anticipated, will propel the vessels at 17 knots per hour in moderate weather.

SIZE.

It has long been known as a matter of experience that the larger the vessel the more economically and profitably she can be worked. But there are conditions which limit the application of this principle, such as depth of water in port, docking-facilities, means of collecting and dispersing cargo, etc.; so that, along with vast increase in the size of vessels and in the number of large vessels, corresponding developments must proceed in the landward side of the question. These, however, must be left for others to record.

Generally, it may be said that, during all the ages in which mercantile shipping has flourished, only slow and moderate growth took place in the dimensions and tonnage of vessels, until after the first half of the past century—doubtless owing mainly to the fact that wood was the material of which they were built; but in this age of steel, and notably since 1890, the building of combined cargo and passenger vessels, of dimensions originally applied only to high-class passenger steamers, has arisen, and has been rapidly developed. Whereas about 15 years ago a cargo-steamer 300 ft. long and of 2,600 tons gross was considered to be fairly large, and one 400 ft. long and of 4,500 tons gross was looked upon as exceptionally large, such vessels have now reached nearly 520 ft. in length and 9,200 tons gross, and between 12,000 tons and 13,000 tons dead-weight; while the length of the Baltic exceeds 700 ft. with gross tonnage of 24,000 tons. There seems to be no reasonable limit to extension, so far as the shipbuilder is concerned; but probably the limits of draught of water will be a determining factor in the problem. The following statement, compiled from a table furnished by Lloyd's Registry, will be of interest. It, however, includes pure passenger steamers not touched upon in this paper, and is confined to vessels built in the United Kingdom. It does not include war vessels.

Many of these vessels are actually larger than stated in the table, as at least part of the tonnage is exempted from measurement in those of the shelter-deck type. On comparing the totals of the returns, it will be seen that there has been a marked increase in the number of large vessels built in the years 1900-1903; in fact, although the grand totals show an increase of 11 per cent. in the number turned out, there was a decrease of 17 per cent. between 3,000 tons and 4,000 tons. The increase in size is particularly noticeable from 7,000 tons upward. Further, 12,000 tons was the limit of size before 1900, whereas vessels have now surpassed 15,000 tons.

In order to illustrate further this portion of the subject the author has obtained from Lloyd's Registers the number and gross tonnage of vessels having a length of 470 feet and upward, which have been built in the United Kingdom and abroad during two periods of 4 years each, namely, 1896-1899 and 1900-1903 inclusive. These particulars are given in the following table:

Summary of All Classes of Merchant Steamers of 470 feet long and upwards, Built in the United Kingdom and Abroad During the Years 1896-1899 *and* 1900-1903.

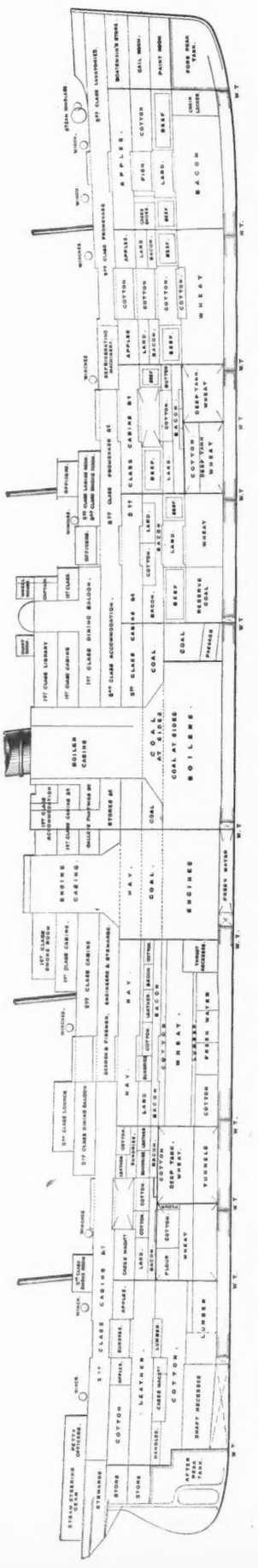
	1896-1899.	1900-1903.
The World's output:		
Total	66	102
Gross tons	607,889	1,040,268
Average	9,200	10,199
Largest vessel	Oceanic, 17,274	Cedric, 21,035
Built in United Kingdom:		
Total	54	74
Gross tons	471,707	751,360
Average	8,737	10,153
Largest vessel	Oceanic, 17,274	Cedric, 21,035
Foreign steamers:		
Total	12	28
Gross tons	136,092	288,908
Average	11,341	10,318
Largest vessel	Kaiser Wilhelm der Grosse. 14,349	Kaiser Wilhelm II. 19,360
Built in America:		
Total	.....	18
Gross tons	.....	158,089
Average	.....	8,782
Largest vessel	.....	Mongolia. 13,300
Built in Germany:		
Total	12	8
Gross tons	136,092	107,066
Average	11,341	13,383
Largest vessel	Kaiser Wilhelm der Grosse. 14,349	Kaiser Wilhelm II. 19,360
Built in France:		
Total	.....	2
Gross tons	.....	23,753
Average	.....	11,876
Largest vessel	.....	La Savoie. 11,884

Before leaving this division of the subject, particular attention is directed to that part of the statement which recounts the recent rapid growth of the shipbuilding industry in the United States of America. The record is phenomenal; for before the year 1900 only about two vessels more than 470 ft. long had been built in American yards, but since then no less than eighteen vessels have been built exceeding this length, having a gross tonnage of 158,100 tons, and an average of 8,780 tons. The largest American-built vessel, the Mongolia, is 600 ft. long by 65 ft. by 51.2 ft., and of 13,300 tons gross, showing that well-equipped yards in the United States are capable of building vessels of the largest size.

The output of very large steamers in Germany deserves comment. Although the number has decreased from 12 to 8, or by 33 per cent., and the gross tonnage has decreased from 136,000 tons to 107,000 tons, or by 21 per cent., the average size has increased from 11,340 tons to 13,380 tons, or by 18 per cent. The largest German vessel, the splendid liner Kaiser Wilhelm II., 678 ft. long by 72 ft. beam, built in 1902, exceeds the Kaiser Wilhelm der Grosse, built in 1897, by 5,000 tons—a highly creditable performance. So far as the author has been able to ascertain, France has built only two vessels of a length exceeding 470 ft. The larger of these is La Savoie, a fine steamer, 563 ft. long by 60 ft. beam, measuring about 11,900 tons. Therefore, although later in the field

Number of Steamers Exceeding 3,000 *Tons Gross Register under Construction in the United Kingdom between the Years Ending March,* 1896-'99, *and March,* 1900-'03.

Tonnage.	March— 1896.	1897.	1898.	1899.	Total vessels.	March— 1900.	1901.	1902.	1903.	Total vessels.
3,000 to 4,000 tons	61	63	102	101	327	78	90	69	42	279
4,000 " 5,000 "	21	15	25	34	95	43	61	44	22	170
5,000 " 6,000 "	22	19	23	34	98	27	24	22	12	85
6,000 " 7,000 "	5	11	14	20	50	15	14	12	11	52
7,000 " 8,000 "	3	4	14	12	33	7	9	10	14	40
8,000 " 9,000 "	3	4	3	1	11	2	4	7	4	17
9,000 " 10,000 "	..	1	..	6	7	4	3	5	3	15
10,000 " 12,000 "	1	3	4	15	23	17	13	15	6	51
12,000 " 15,000 "	..	..	..	..	..	..	..	..	5	5
15,000 and above	..	..	..	..	..	..	..	..	4	4
Grand total					644					718



Profile Illustrating Method of Loading an Intermediate Atlantic Liner.

than Germany, the United States has become the principal competitor of England in the shipbuilding industry.

CAPACITY.

The immense capacity of the modern steamer for both measurement and dead-weight cargo indicates the vast strides which have been made in commerce, especially in later years, when vessels have grown in size with marvellous rapidity. For example, the intermediate steamers Cymric, Ivernia and Saxonia, have a dead-weight capacity of about 12,200 tons, and a measurement capacity of about 20,000 tons at 40 cu. ft. per ton. The accompanying profile will convey some idea of the labor needed to fill a steamer of this capacity. It shows a vessel laden with a mixed homeward cargo, composed of 187,200 items and weighing 8,360 tons; it illustrates the skill with which such vessels are stowed, with the object of not only filling the holds, but of filling them in such a way that the vessel may be easy in her movements at sea. On a recent voyage, a vessel of the Ivernia class brought from the United States, as a portion of her cargo, 39,433 barrels of apples, weighing upward of 2,960 tons; the number of apples being about 18¼ millions. In addition, she brought about 71,000 bushels of wheat, and a vast collection of miscellaneous articles.

CARGO-APPLIANCES.

Unless a large vessel has means of readily loading or discharging her cargo, she will be placed at a serious disadvantage when compared with smaller vessels having a quicker despatch; moreover, detention in port will neutralize the advantages gained by speed at sea. One day saved in discharging or loading a fully-employed tramp will mean about 1 per cent. of her capital cost; it is therefore natural that cargo-appliances are receiving increased attention. The winches have been multiplied, their speed has been increased, and now they often run for hours without being stopped or reversed. Manilla and small flexible steel-wire runners are generally employed for light lifts; derricks are more numerous; hatches are wider; and frequently two hatchways are provided in each hold. In the August Belmont the cargo is worked by 16 derricks, which swing from ten vertical derrick-posts, and land the cargo 13 to 16 ft. over the side. All these can be raised or lowered by tackles so as to vary the reach. There are nine hatchways, four of the holds having two each; they are 14 ft. to 17 ft. long by 21 ft. wide. The Mystic, a collier of similar design, by the same builders, carrying 6,000 tons dead-weight and steaming 11 knots per hour on a voyagle of 545 miles each way, made 32 voyages in 1901 in 9 months 18 days, steaming 44,756 miles. In 1902 she made 36 voyages in 11 months 19 days, and steamed 55,929 miles, loading and discharging in 1901 187,200 tons, and in 1902 210,600 tons of coal. Her average cargo was about 5,850 tons, besides her bunkers. These figures will give an idea of the heavy wear and tear such ships are subjected to, as each voyage means pumping out and filling nearly 2,600 tons of water-ballast, raising and lowering hinged hatches at least twice, mooring and unmooring at terminal ports, towing to and from the ship, etc.; besides working the engines ahead and astern, going alongside at each jetty, and usually anchoring once or twice per voyage. With the turret class of vessel have been introduced startling innovations, which are exemplified in an unsurpassed degree in the Grängesberg. She has 12 large hatchways, which work six separate compartments for ore, and has seven pairs of derrick masts fitted abreast, which carry 24 derricks, worked by 12 double-ended winches. She is fitted with portable platforms for delivering ore over the side as it is lifted from the holds, and discharges her cargo of about 10,000 tons in 35 hours.

Ships' appliances can now load and discharge cargo faster than it can be supplied to the vessel or taken away. Grain can be elevated into and out of steamers; oil can be pumped both in and out; coal can be tipped in, and taken out by bucket or grab. In fact, it is seldom that general cargo can be accumulated rapidly enough to serve a large modern steamer, except in the case of liners which have fixed sailing days, full or empty. The main difficulty in getting good despatch in loading is that the cargo is frequently not to hand. Delay in discharging occurs on account of want of sufficient space for delivered cargo, and because the customs of certain foreign ports allow the consignee to take delivery in the leisurely way of the sailing-ship days. Further, in the case of overside delivery, each parcel of cargo has to be sorted on the deck before it can be delivered to the lighter or coaster alongside. All this shows that at present the up-to-date steamer is ahead of the shore arrangements.

Electric lighting for vessels has become universal; but although electricity is usefully employed in shipyards for hauling and lifting, it has not yet found general acceptance in steamers for working the cargo. Cost appears to be its chief drawback. Cannot electricians produce a noiseless electric winch, at a cost not exceeding that of a steam-winch, and deriving its power from a good compound engine, which will tempt owners of cargo-vessels to adopt it in place of the present winch equipment, with its inconvenient pipe-service and multitude of non-expansive engines, wasteful of steam and costly in upkeep? Of course, the steam-engine and dynamos would have to be of a reliable character, for, should they fail, the whole installation would be rendered useless; but such a fear should not have too much weight, as hydraulic cargo-gear depends also upon a single steam-engine. Economy of steam would certainly result.

ECONOMY OF WORKING.

The ease with which large vessels are propelled, and the speed obtained with full models, are remarkable. Experience has proved that well-designed vessels of full form can be driven on a remarkably low consumption of fuel. For instance, the Ivernia and Saxonia steam about 15½ knots per hour on 140 tons per day, with about 20,500 tons mean displacement. The Carpathia, a similar but smaller vessel, steams 15 knots per hour on 115 tons per day, on a mean displacement of about 19,000 tons. The Monarch, a cargo vessel built by Messrs. Swan & Hunter, lifting about 11,600 tons when loaded, steamed at an average speed of 11.35 knots per hour on two North Atlantic voyages, on a coal-consumption of less than 48 tons per day; the outward voyage was in ballast and bunkers, and on the homeward voyage the vessel was fully laden. The cost of conveying ordinary cargo in a liner from the United Kingdom to the Port of Bombay is about $6 per ton weight, including dock-dues, loading, discharging, depreciation and maintenance of steamer, and Suez Canal dues. This figure applies to goods sent alongside in lighters. If the vessel were loaded from a wharf, the gross cost would amount to about $7.25 per ton. Considering that the distance is about 6,400 miles, the cost per ton-mile, based on a $7.25 rate, would average about 1.1 mills, and in a tramp carrying coal or grain, much less. With regard to passenger traffic, third-class passengers are conveyed across the Atlantic at a speed of 15 to 16 knots per hour for about $26 per head. This works out at approximately 1 cent per mile, including board and lodging. (During the steerage rate war, passengers were carried on one of the English lines for $8.00, presumably at a loss.—EDITOR.)

A number of tankers have been fitted with bunkers and appliances for the use of oil or coal as fuel; but at present liquid fuel does not appear to lead to sufficient saving to encourage the extension of its use to general cargo-vessels, although there is a saving of about 15 per cent. in bunker-space when oil-fuel is carried, as oil measures approximately 37 cu. ft., and coal 42 to 45 cu. ft. per ton. The relative daily consumption of oil and north-country steam-coal is about 17:27, by weight; but the relative cost of bunker-coal and oil-fuel necessarily varies with the source of supply. For instance, coal ranges from $4 per ton in London to $8 per ton at Singapore; whereas the cost of oil increases in the inverse order, being about $5 per ton in eastern ports, and $8.75 per ton in the Thames. This points to the advisability of using coal for outward eastern voyages and oil for the homeward voyages. It would be a great boon if oil-fuel could be supplied at such cost, and in such quantity, that liners could depend on using it. The annoyance of coal-dust and the delay from bunkering would disappear, while the various appliances for bunkering through the side and over the decks would be replaced by pipes and side nozzles. Besides the troubles in connection with firemen, the difficulties of maintaining steady steam, and others incidental to coal-burning, would disappear. But this desirable end will probably be reached only when oil can be obtained from independent sources of supply, as coal now is.

The Valtellina Line and the Electrical Operation of Railroad Main Lines.*

BY THEODORE KÖHN.

I.—INTRODUCTION.

The great economic importance of reducing the cost of operation of railroads to the lowest possible figure, has in recent times led to several results. Improvements have been made in the construction of the steam locomotive with the purpose of increasing its efficiency by a more complete use of the steam, by diminishing the harmful effects of the moving masses, by a more advantageous burning of the coal, and by other means. But more than this, considerable activity has been aroused to determine by tests on a large scale whether, just as in the case of street and suburban railroads, main lines as well could not be operated more advantageously by electricity than by steam.

The results secured with a mixed steam and electric service on the Wannsee Road of the Prussian State railroads rendered further tests superfluous here, but the authorities granted the use of the military line between Marienfeld and Zossen to the Society for the Study of Long Distance Railroads, of Berlin, for a thorough investigation of the highest attainable speed by the two firms, Siemens & Halske and the Allgemeine Electrizitäts Gesellschaft; the results of which have attracted so much attention in the technical world.

In these trials tri-phase current at 13,000 volts at the trolley wires was used directly for driving the trains, and no use of the rails made for return, so that the sliding contact had to be a triple one.

Among other experiments one deserving of special attention is the electrical operation of the 40 km. line in Switzerland, between Thun and Burgdorf, installed by Brown & Boveri in 1900, and in use since that time. Tri-phase at 4,000 volts is generated in the hydraulic turbine station at Spiez and stepped up to 16,000 volts by static transformers. Fourteen transformer stations are arranged along the line, stepping the voltage down from 16,000 to that used on the trolley, that is, 750 at full load on the substations. Thus three-phase is applied directly for running the trains.

In October, 1896, the firm of Ganz & Co., using a trial line of 0.8 km. length, 1.0 m. gage, 6.5 per cent. maximum grade and 20 m. as least radius of curve, began its first tests with a two-axle car equipped with but one motor, after having made exhaustive preliminary investigations. The two-phase current at 500 volts was brought to the car by way of two copper wires of 8 mm. diameter, hung from common span-wires, and was taken off by two ordinary trolley wheels. The overhead work had one turnout and one crossing.

The first practical result of these tests was the building of the three-phase line in the watering-place Evian-les-Bains on Lake Geneva, running from the Avenue des Sorces to the Grand Hôtel. It is 0.3 m. long, and its steepest grade is 10.2 per cent. In operation since 1898, it has proved faultless. This was followed by the mine railroads of the Hungarian state iron mines in Vajda-Hunyad and Pereczes, as well as by the three-phase mine locomotives for the French Compagnie des Mines de la Mure. On these roads three-phase current at not more than 500 volts was used.

In common with the great American General Electric Co. the French Thomson-Houston Co. and the Union Electrizitäts-Gesellschaft are of the view thus far that d.c. drive is more economical than three-phase for railroads, especially at starting, and hence for roads with comparatively short runs. They also hold that the cost of maintenance of the three-phase drive is very much greater than for d.c. at the customary voltage because of the greater difficulty of insulation.

They assert that these circumstances counter-balance the losses incurred by converting high tension three-phase into direct current and the interest on the increased investment for the third rail as against a pure three-phase installation.

In view of the present state of information regarding electric operation for railroads

*Translated from the *Organ fuer die Fortschritte des Eisenbahnwesens*, November, 1904.

the Italian government took it upon itself to invite the two great Italian railroad companies, the "Società per le Strade Ferrate Meridionali, Esercente la Rate Adriatica," and the "Strade Ferrate del Mediterraneo," to take up the question of electrically operating main lines and to submit recommendations on the subject.

Conditions for electric operation were favorable for both companies, since there was a prospect of their being able to use, instead of high priced imported coal, the extensive water-powers on the southern slopes of the Alps. This could be done under circumstances advantageous for electric railroading, as permission to use water powers is, in accordance with Italian law, only granted after the railroads have declared them unavailable for their own purposes. But both companies are only operating tenants until June, 1905, of their systems, these belonging to the state. The prolongation of their contracts by the House of Deputies is uncertain. Moreover, the government stipulated that the sum previously to be agreed upon for the entire electric equipment was only to be paid when the trial should have been proved to be entirely successful. Under these conditions the "Adriatica" would allow itself to become involved in a test only if the concern installing the work would take full responsibility for its successful completion, and therefore in the year 1898 turned to the firm of Ganz & Co. in Budapest.

Since this was a matter of working out an entirely new mode of traction, differing in all details from that previously in use, the company built an experimental road, of the form of a closed oval, about 1.5 km. long on the island of Altofen for testing the appliances. The power station of the shipyard delivered the current, a steam engine of 250 h.p. being used. For the experiments, which were carried on for 15 months without interruption, a motor-car running-gear was used with a wagon-body built especially for this purpose.

The great confidence which the Credito Italiano in Genoa and the banking house of Manzi & Co. in Rome had for the new mode of traction induced these houses to join with the "Continental company for electrical undertakings" in organizing for this purpose the "Società per la Trazione Elettrica sulle Ferrovie," with a capital of five million lire, to close a contract with the "Adriatica" to the effect that it would be obliged to meet the cost of installation only when success was demonstrated. In return the "Adriatica" submitted to the condition that even in case of failure of the electric traction the use of the Adda water-power should remain with the "Trazione" during the life of the grant. The "Trazione" took over the contract between the Adriatica and Ganz & Co. of March, 1899, which was based on a scheme of partial payments extending over several years, and assumed the part of purchase with respect to Ganz & Co. after this company's design for the electrical installation for the lines Lecco-Colico-Chiavenna and Colico-Sondrio had been approved by the royal General Inspection of Italian Railroads in April, 1898.

The firm of Ganz & Co. undertook to provide and install the main transmission line, the transformers, the line-equipment and the means of operation, as well as to deliver the turbines for the power house in Morbegno. The electrical equipment of the power station was undertaken by the electrical company formerly Schuckert & Co., while the hydraulic work was done by the "Società per la Trazione" at its own expense.

II.—COMPARISON BETWEEN THREE-PHASE AND THREE-PHASE-D.-C. OPERATION FOR MAIN LINES.

The problem of electric traction for main lines consists in transmitting large power over great distances, for which purpose high tension a.c. only is adapted, since a.c. generators and transformers can readily be produced for high tensions, and the latter have no moving parts. To operate longer lines with d.c. involves dividing them into sections with separate generators, driven either by individual steam engines or by electric motors which receive high tension three-phase from a common power station. Instead of the generators rotary converters may be used, but in that case it is necessary to step down the voltage by appropriate a.c. transformers. This arrangement is only of advantage if the traffic is dense and trains small, so that the load on the section power-stations is made approximately uniform by several trains running on each section, and the peak load caused by the small trains shall not be excessive.

This scheme of resolving the trains in street-car fashion cannot, however, be used with trunk line traffic having heavy freight trains and through expresses. Instead, large trains have to be despatched at longer intervals, requiring a far greater supply of power for their propulsion, hence the occasional maximum loads on the substations will differ much more widely from the mean than in street railway power stations.

On street railways with five to 20 minutes' headway the maximum demand amounts to 1½ to 3 times the average. This ratio becomes much more unfavorable if the traffic is of a main line nature.

Take for instance a straight level piece of main line, 15 km. long, 8 km. between stations, trains running on 90 min. headway in each direction, highest speed 70 km., weight of trains 300 tons.

The greatest demand for power comes when two trains are started simultaneously in the same section, but this case can be avoided by the arrangement of the schedule; but it may happen that one train will start while the other is running at full speed. In this case the maximum demand for power will amount to the sevenfold of the mean. If three trains are in one section, or two start together, it may even rise to 10 times the mean.

Now if the substations are designed for the highest load, they will prove to be much larger than would correspond to the mean load; their efficiency and economy becomes unfavorable and the cost of installation rises to such an amount that electrical operation is impossible.

Were the attempt made in such a case to balance the load by feeders, this solution would be materially affected by the costs of their installation and maintenance. For the assumed example the installation would cost some 145,000 M., the maintenance annually 6,000 to 7,000 M.

A much cheaper solution of the problem of electric trunk line operation is secured if instead of converting the a.c. to d.c. in substations, its tension is reduced by step-down transformers and the a.c. used directly at a low voltage for feeding the car motors.

The ability of the a.c. transformer to stand considerable overloads, in contrast to the d. c. generators which rarely stand over 50 per cent. overload, is limited only by the heating or loss of voltage. If the limit of overload is fixed by the highest current and correspondingly great drop in voltage, then the transformer must be designed on account of the heating for only so much more than the mean load as the square root of the mean value of the squares of the instantaneous current-strengths exceeds the algebraic mean of the same current strengths.

In the above example a d.c. generator of at least 1,000 k.w. usual capacity would be needed, while if a.c. is used a step-down transformer of 350 k.w. will serve the purpose abundantly.

Thus while the d.c. generator for the substation in question (if no balancing feeder is used) would have to be designed for at least five times the mean load, an a. c. step-down transformer would suffice if it had a capacity only 67 per cent. higher than that called for by the average load. Such a transformer costs some 20,000 M., or only a seventh as much as the feeder, where the cost of the d.c. generator, or of the rotary, has not even been considered.

If in the working conductors also a.c. at high voltage is used, then longer sections may be assumed for the substations, so that the loads will average up more uniformly, and the costs of installation and operation are reduced.

To a greater extent this is true also of the great power stations furnishing the feed-current. The higher their voltage, the more substations, hence the longer lines, can be connected to them, and the better the loads on the several sections will balance up, and will also tend towards making more favorable the ratio of the highest to the mean demand.

But this does not exhaust the advantages of high tension; raising the voltage also considerably diminishes the expense for conductors.

With different voltages, but equal power to be transmitted over equal distances and with the same loss permitted on conductors the cross-sections of the conductors will be as the squares of the currents. Comparison of the section of conductors for three-phase at 3,000 volts with that for the highest d.c. voltage, 700, thus far used for railroad operation shows under the conditions just mentioned that the cross-sections for the latter are 10 times as much as for the former. Conversely in the former case the distance between power stations may with equal conductor cross-sections, equal work to be transmitted, and equal losses of energy in the conductors, be 10 times as great as in the latter. It is also to be observed that the loss of power in the rail return is of the greater consequence the lower the voltage and the greater the current, for only with high voltage and small currents may the losses in the return circuit of rails be ignored.

Numerically the comparison between three-phase at 3,000 volts and d.c. at 700 volts on the line appears as follows: The cost of the two copper wires of 8 mm. diameter required for the former amounts to 1,700 M./km., that of the 1,000 sq. mm. conductor for the latter to 17,000 M/km., or 10 times the first.

If with d.c. a third rail is used as current-supplying conductor, then there will correspond to the conductor of 1,000 sq. mm. section a steel rail of 62.5 kg/m., of which the cost would be about 12,000 M/km. without copper bonds.

Attention has already been called to the fact that great variations of load on the generators in the power station will increase the costs of installation and operation; for this reason the voltage on the feeders between the generating station and the transformer stations ought to be so high that the former can supply all the substations on the whole line, so as to average up, as far as may be, the demand for current among the various sections, and secure uniform loading.

Thus while the raising of the working voltage to the extreme limit, so as to secure a more favorable loading, is not justified, yet in general for feeding the transformer stations as high a voltage in the power house as possible ought to be chosen.

(To be continued.)

The Inter-Pole Variable Speed Motor.

The Electro-Dynamic Company, formerly of Philadelphia, Pa., has recently moved into new and modern shops at Bayonne, N. J. This company has designed a new variable speed motor which can also be used for constant speed work. The motor has a wide range of speed, is sparkless and can be run in either direction without shifting the axis of commutation. These results are obtained by the use of small series coils wound on poles placed between the main field poles. The main field poles are shunt wound and the inter-poles are in series with the armature. The speed is controlled by resistance in series with the shunt field. An ordinary shunt wound direct current motor would spark if the field strength were decreased, but sparking is prevented in this motor by the inter-poles which give a field for commutation. In a constant speed motor the two main causes of sparking are self induction and the action of the short circuited coil in generating and maintaining an electro motive force by cutting the field of the armature. These are overcome, in part, by the resistance of the brush contact and also by placing the brushes so that the short circuited coil is in the edge of the main magnetic field.

While it is possible in the constant speed motor to control the sparking by the means mentioned above, these means are entirely inadequate for the variable speed motor. The reduction of the field strength necessary to obtain the high speeds, prevents its use in overcoming the magnetic field of the armature. The armature field is, therefore, not only present, but the increased speed of the armature proportionately increases the maintaining e.m.f. until it becomes so large that the carbon brush cannot overcome it. The increased speed of the armature also increases the e.m.f. of self-induction. As a result it becomes impossible for the carbon brush to reverse the current in the short-circuited coil, and in consequence there is destructive sparking on the high speeds. In order, therefore, to control these e.m.fs. it is necessary to provide a magnetic field independent of the main field of the motor. This is done in the inter-pole motor by auxiliary poles, which are small compared with the main poles, and are between the latter and provided with coils connected in series with the armature, so that all of the current taken by the latter flows through the coils of the auxiliary field, which are proportioned and arranged so as to give the proper field for commutation. All of the coils of the auxiliary field being connected in series with the armature, weakening of the field of commutation by an increased load is prevented, and the auxiliary poles produce the required compensatory field of commutation independently of the main field, which with increased number of revolutions of the armature must be correspondingly weakened. Moreover, the function or effect of the auxiliary poles is independent of the direction of rotation of the armature, because if the latter is reversed the current in the auxiliary field is also reversed. The motor operates on any two-wire, direct-current circuit from 110 volts to 500 volts. Its characteristics make it particularly well adapted for directly driving machine tools.

The motor has ball bearings instead of the usual journal bearings. These bearings are of special design, consisting of two races, one of which is on the armature shaft and the other is on the bearing housing. Spring separators are between the balls, and inside of the springs is a mineral wool which holds the lubricant and feeds it gradually to the bearing. The general design and arrangement of a 5 horse-power motor is shown by Figs. 1, 2 and 3. The electrical connections are shown in Fig. 4.

The results of tests on a 5 horse-power

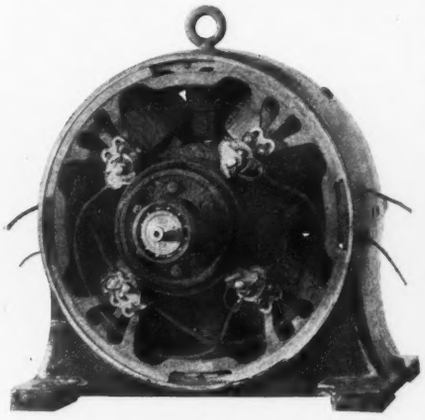


Fig. 1.

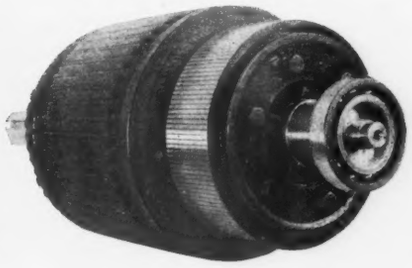


Fig. 2.

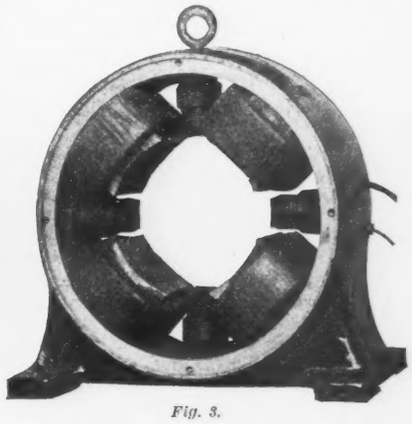


Fig. 3.

The Inter-Pole Variable Speed Motor.

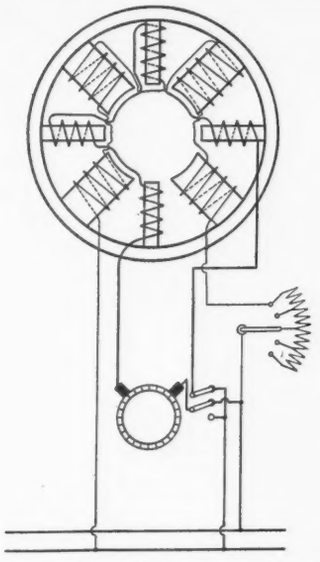


Fig. 4—Wiring Diagram of Inter-Pole Motor.

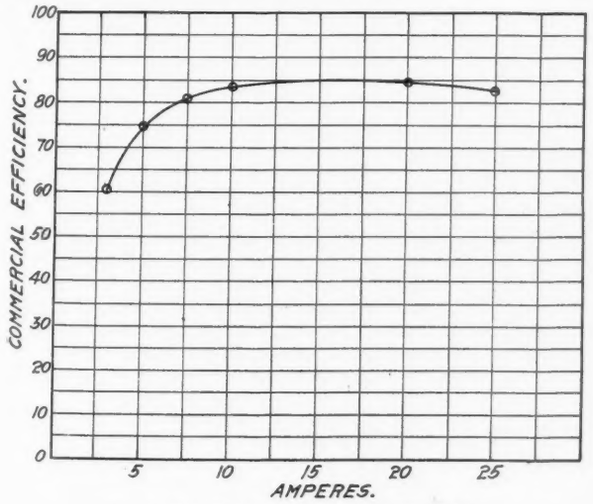


Fig. 5.—Constant Speed, 220 Volts, 750 R.P.M.

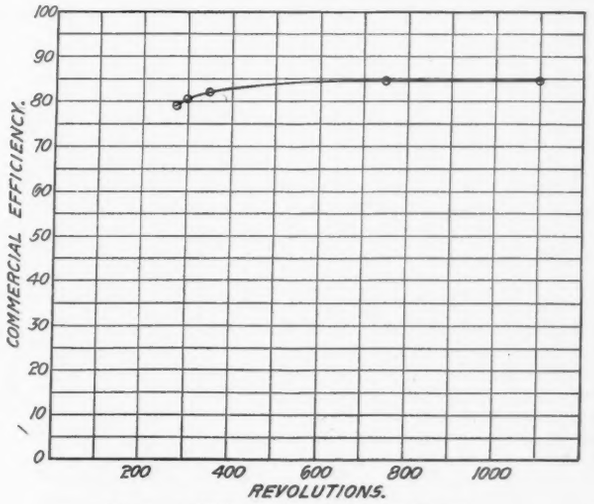


Fig. 6.—Variable Speed, 220 Volts, 20 Amperes.

Efficiency Curves of Five Horse Power Inter-Pole Motor.

inter-pole motor are shown in Figs. 5 and 6. At 20 amperes (the full load) the commercial efficiency, as shown by Fig. 5, is 84 per cent., the highest efficiency being 85 per cent. at three-quarters load. This curve is very flat, the efficiency being very high except at exceedingly light loads. Fig. 6 shows the commercial efficiency of the motor when running at full load at different speeds. The efficiency, at all speeds between 300 and 1,100 revolutions, is more than 80 per cent., and the flatness of the curve shows that the motor is very efficient at all speeds within its range.

Picked Up on the Road.

BY GULF.

If the chirpings of the birds are to be believed, those roads which have invested in the steel cars of 100,000 lbs. capacity, have not yet seen the end of their troubles nor are they yet entirely beyond the shadow of the forest, in the matter of cast-iron wheels. It is well-known that when these cars were first put into service on some of the mountain roads cracking of flanges was so great as to be very serious and even alarming. Changes in the shape of the wheel back of the flange, the use of more and of heavier brackets and a modification of the shape of the plate, helped matters wonderfully; but the trouble does not seem to have been entirely done away with. It appears that even now when new cars are put into service on mountain divisions, there is apt to be considerable breakage until the weaker wheels are weeded out. The upshot is that steel-tired wheels are being considered with some seriousness for these high capacity cars, and the results of the trial on the Pennsylvania R. R. are being awaited with a great deal of interest.

Casual inquiry indicates that there would be a rapid adoption of softening processes in bad water districts if the superintendent of motive power could have his way. Where bad water, that is very bad, can be softened and rendered inoccuous for from 2 to 3 cents per 1,000 gallons, and where the life of tubes by this method can be lengthened almost indefinitely instead of being limited to from three to 12 months as we sometimes find them, it is no wonder that the mechanical department looks with longing eyes towards something that will relieve it of tube troubles, lessen delays due to such troubles, and cut down maintenance expenses. This sentiment seems to be gaining ground with such rapidity at present that the prospect is that there will be a rapid increase in the use of water softening processes for locomotives in the near future.

The Holman locomotive, of speeding truck fame, whose performances on the Southern Railroad of New Jersey were so widely heralded a few years ago, and which was so adversely criticized in the *Railroad Gazette* at the time (April 9, 1897), has recently had another trial on the Buffalo, Rochester & Pittsburg. Its prestige has not been enhanced by its late performance. It is now resting, or "at liberty," as the actor would say, and roundhouse speculation is rife as to what investor will be induced to lock up capital in the absurd scheme.

The layman will probably never cease to wonder why the railroad man does not do things differently, but when it comes to the use of man power instead of compressed air or electricity for the moving of heavy burdens about a shop, such as the operation of transfer and turntables, it looks very much as though there was a basis for the wonderment of the otherwise intrusive layman. The writer knows of a transfer table that has now been in use for about 25 years, and, during the whole of that period, has been moved by a gang of men called from their work in the shop, with a rope rove through a snatch block. What it costs to use from eight to 20 men on a job like that, for lengths of time dependent upon the weather and the state of the rails, it is hard to calculate, but it is quite safe to say that the labor cost would pay a handsome dividend on an investment in an electric motor. It may be added that there is a current-bearing wire within 50 ft. of the job.

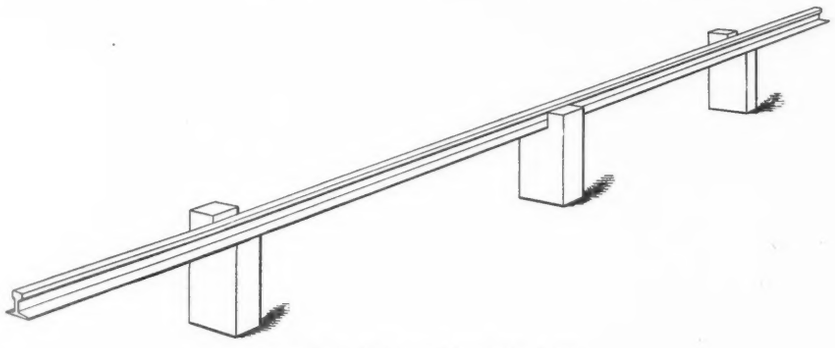
Such conditions as the one just mentioned lead one to believe more in the survival of that which is, rather than in the survival of the fittest, especially when no one is personally interested in bringing the "fittest" to the front. This seems to hold true of the use of the wooden truck bolster. For years the car builders of the country have been bemoaning the fact that truck bolsters sag, that the cars get down on the side bearings and that a hard-pulling train is the result. Yet within the past two months a lot of freight cars were turned out of the shop of a road that aspires to be a trunk line, with wooden bolsters without even any trussing; bolsters which will be as sure to yield under a load as the sun is to rise. All past experience points to the fact that they are unsuited for this work and yet this obsolete construction survives. And again the layman is wont to inquire why it is, and wonder at the seeming blindness of the railroad man in using such a construction when there is something so much better at hand.

It sometimes seems as if the rage for heavy engines was running rampant, to an extent not always in harmony with true economy of management. There are some runs, constituting part of the regular work of the road, that can so well be taken care of by light engines that the use of abnormally large ones is an extravagance. In a certain locality, 25 years ago, the service of hauling a train of 150 tons on a schedule averaging 30 miles an hour was satisfactorily performed by engines having cylinders 16 in. in diameter with a 24 in. stroke. The writer happened over this same division, the other day, and found engines with 19 in. by 26 in. cylinders assigned to the same work. The engines were bought in an excess of zeal to provide for a traffic that never came. It looks like rushing into new designs without due consideration.

A letter in a recent issue of the *Railroad Gazette* to the effect that the average man would rather ride on a train running on a slow schedule and get there on time than start under the hallucination of high speed and reach his destination late, is a reiteration of a remark that so many men have made before that it has become threadbare, yet there is little hope of its ever reaching the eyes and permeating the brains of the men who have to do with the making of time-tables. It might be said that a time-table is a guide indicative of the time at which one must be at the station prepared to wait for a train, rather than that at which the train may be expected to arrive. The large percentage of late trains on American railroads makes the close calculation of connections a pure case of gamble, and high speed schedules a good deal of a farce. It resembles (somewhat inversely) the present method of issuing a January magazine in the middle of December or the publication of the 6 o'clock edition of an evening paper at 2 in the afternoon. It is meaningless and absurd.

The writer received an unconscious comment on this matter of late trains the other day, from an interested official. Calling at his office at a rather early hour, he found the official at his desk, and commented on the fact of his being an early bird. "Yes," he replied, "I like to get here early, and have always made it a practice to do so. I could just as well take a regular train, and get here a little later, but the fact is that it is almost always late, so I take the shop train, which I know will leave on time." Again the question arises: "Does it pay to advertise a fast schedule that cannot be maintained?" Surely the annoyance to the operating officials of working a train over the rails that is behind time, must exceed any imaginary benefit from trying to humbug the public into believing that they will arrive at their destination at a certain hour, when the wise ones know the chances are all the other way.

The accompanying sketch shows the form of extra rail-holder that is used on the Van-



Extra Rail Holder—Vandalia Line.

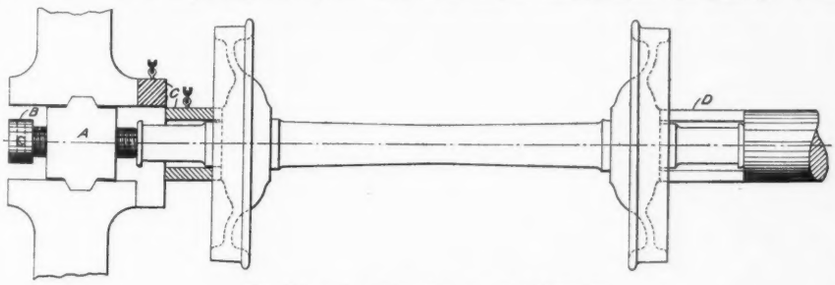
dalia Line. It is formed of three notched ports set in line with the middle one facing in the opposite direction from the other two. By this arrangement the rail is prevented from falling to the ground and at the same time it can be easily picked up for use or another dropped down into place. There is nothing very remarkable about it, other than that it is a handy arrangement for the purpose for which it is intended.

Greater care could well be expended on the selection and adjustment of car springs. It is confessedly no easy matter to do this work in a way that will produce ease of motion in the moving vehicle. There are many factors that have an important influence on the final result. For example, a few that may be mentioned are the weight of the car, the average and maximum speeds of the train, the condition of the rails, and finally the mutual and resultant inter-action of the

equalizer and elliptic springs, for it must be borne in mind that it is not every set of equalizer springs that will work well with every set of elliptics, even if the two have the same nominal capacities. There is probably no one thing in car construction that adds so much to the comfort of the passenger as a fine spring suspension, so that passenger agents can well urge the car department to pay particular attention to spring suspension and stop that annoying jiggling that is so common. It is not necessary to name delinquents in this respect, but if this should be done, a number of roads that stand for the best that there is in the railroading of America and the world would be well up on the list.

It takes a man who is on the alert to keep all of the little leaks in shop management effectively plugged. Perhaps the most difficult of the small problems that require attention is that of the movement of material. The immediate cause of this note is an example of a pretty source of waste, observed a few days ago. In the bolt making department of a large road, the manufactured article was carried from the heading machine to the cutter in iron barrows, propelled by man. As the bolts were headed they were thrown in a heap on the floor. Afterwards they were gathered up and put in the barrows and wheeled to the cutters. The natural inquiry came; why not throw the blank bolts directly into the barrows and save this slow extra handling? If this had been done, the greater part of one man's time would have been saved, which, being capitalized, means how much?

Pressing on car wheels to the proper point on the axle is sometimes made an elaborate and slow piece of work. At times things are made handy and the work goes through with a rush. A handy arrangement of the wheel press that helps mightily and prevents over or short pressing at either end is shown herewith. A stop block, A, is set in notches in the tail casting of the press. In it there is fitted a heavy adjusting screw, B. The



Blocking for Pressing on Car Wheels.

bearing, C, for the wheel rests, as usual, against the tail block. The screw is then run in or out until the distance from the tip to the edge of the casting, C, where it serves as a bearing for the wheel. At the other end there is horseshoe casting, D, whose width is also equal to the distance from the face of the hub to the end of the axle. The wheels and axle are run in in the usual way and the press started. At the ram end of the axle the casting, D, pushes on the wheel until the ram itself comes into contact with the end of the axle. Then that wheel can be pushed on no farther. At the tail end the axle is pushed through the wheel until it strikes the end of the screw, B, when it can be pushed through no farther. So when the axle reaches from the ram to the bolt, both wheels will be found to be in their proper positions. Of course, the value of the process depends upon the accuracy and constancy of the distance from the face of the hub of the wheel to the gage line, a distance of which the variations should not be greater than those allowable in the gage. As a matter of fact, in watching a large number of wheels pressed upon the axles with this device, they all came accurately to gage, and the rapidity of the execution far exceeded that which would have been possible by adjusting the blocking for each end, and stopping the press in the middle of the work. With it, the press can be started and run without stopping until both wheels are on. It then puts its whole pressure on the axle and can do nothing more.

The use of large sheds that protect the men from the inclemency of the weather is becoming more and more common for the repairing of freight cars. The old idea that cold and discomfort was a good thing for the men, as it made them more active and hustling about their work, has long since been abandoned for the shops and now bids fair to die out in practice, as it has long since in theory, in freight repair yards. The shelter has come in many places but it has not yet been considered a prime requisite of such accommodations that they should be heated in cold weather. That will undoubtedly come in time, and when it does, it will probably show the same relative decrease in the cost of freight car repairs that the heating of the shop has shown in that of doing machine work.

The Cost of Locomotive Operation.

BY G. R. HENDERSON.

(*Continued from page 140.*)

FUEL.

Price.—Ordinarily the price of a commodity is supposed to give some indication of its quality, but with coal this is seldom the case. The costs of production and transportation are alone responsible for the prices charged, and neither of these, as a rule, has any direct bearing upon the quality. It is true that the Pennsylvania anthracites, which are very rich in heat units, require expensive machinery for their preparation; on the other hand, the West Virginia semi-bituminous and the Pittsburg bituminous cost about the same to mine as the inferior coals of Kansas and Iowa.

Then again, it costs no more to haul a ton of good coal than a ton of poor coal, so that the distance from the mines producing the higher grades is the only indication of the comparative value of this fuel. Certain localities are noted for the fine grades of coal furnished, although there may be adjacent mines very much inferior. This is particularly true of the West Virginia fields, for while the New River and Pocahontas mines are well known as the best in the country, the coal produced in the western part of the state is much less desirable.

This state of things accounts for the fact that we will often be able to obtain a good quality of coal at a lower figure than a poorer product. The Norfolk & Western and the Chesapeake & Ohio, running in close proximity to the Pocahontas and New River coal fields, obtain the best steam coals in the country at figures generally below one dollar a ton, while the railroads of the southwest pay from $2.50 to $3.00 a ton (or more) for a much less desirable article. If we contrast the cost of heat units, we find a still greater discrepancy. Thus for the New River coal, containing 14,000 B.t.u. at $1.00 per ton, we have

$$\frac{14{,}000 \times 2{,}000}{1.00} = 28{,}000{,}000 \text{ B.t.u.}$$

purchased for a dollar. Arkansas coal, containing about 11,000 heat units, costing $2.70 a ton in Texas, gives us

$$\frac{11{,}000 \times 2{,}000}{2.70} = 8{,}150{,}000 \text{ B.t.u.}$$

for a dollar, a price 3½ times as high as in the previous case, and its effect upon the cost of transportation is felt accordingly. Nearly all railroads have more or less option in the matter of purchasing coal, and it then becomes a consideration of getting the most *heat* for the least money. In a lecture before the engineering students of Purdue University, in December, 1903, Mr. W. H. Bryan illustrated this point by a table which is partly reproduced below. This shows the cost of various fuels at St. Louis, the heat units contained in a pound, and the cost of evaporating 100 lbs. of water, which would be about equivalent to a movement of 50 ton-miles on the basis before assumed.

Values of Coal at St. Louis.

Kind	Cost, per ton.	B. t. u., per lb.	Cost of evaporating 100 lbs. of water.
Anthracite	$6.75	14,000	31.08 cts.
Coke	4.50	12,500	24.87 "
Pocahontas	4.75	13,300	24.00 "
Big Muddy	2.50	12,200	14.60 "
Mt. Olive Lump...	1.60	11,200	10.62 "
Common slack	.90	10,000	7.25 "

Such a comparison should always be made by every railroad company before making its contracts for fuel, but consideration must also be given to the fact that some kinds of fuel will not be satisfactory for high grades of service (passenger, for instance) unless the engines are designed especially for it. Thus, by building locomotives with grates of 80 or 90 sq. ft. of surface, the Reading was able to use anthracite culm, a fuel which had no value for locomotives as ordinarily constructed. Another case is that shown below, in which the figures are taken from some tests made on the Chicago & North Western in 1900. Two kinds of Illinois coal were tried, which we will designate as A and B, costing $1.72½ and $1.57½ respectively. An ordinary eight-wheel engine with narrow firebox, and an Atlantic type, with wide grate were used, the former hauling eight-car trains, and the latter nine-car trains, the distance being 143 miles.

Result of Coal Tests.

Kind of coal.	Type of engine.	No. of cars.	Cost— Per ton.	Cost— Per trip.
A.....	8-wheel	8	$1.72½	$9.68
B.....	8-wheel	8	1.57½	9.89
A.....	Atlantic	9	1.72½	10.83
B.....	Atlantic	9	1.57½	10.60

It was generally conceded that the "A" coal was the better—fully equal to the difference in cost, and the eight-wheel narrow firebox engine showed greater economy per trip with this fuel. The wide firebox engine, however, had so much grate that the poorer coal could be burned to advantage (perhaps with smaller draft and less cinder losses) and was even the most economical for the whole trip. This shows the importance of considering all the points at issue.

On large systems, the various divisions must be supplied with coal from contiguous mines, if possible, and this causes a difference in price for different portions of

the road. In some cases it is pro-rated and charged out at a uniform figure throughout. On the Santa Fe a combination of these two methods was used. The coal used on the ten divisions of the original system was pro-rated and for a certain month was charged out at $1.50 per ton, regardless of its actual cost or quality. For the same month the Albuquerque division was supplied with its fuel (a new Mexican lignite) at $1.16 per ton, and the Northern division (of Texas) was charged $2.48.

The changes in price in short lapses of time are often quite startling. Thus in two months, the figure for New Mexican lignite fell from $1.51 to $1.16 per ton; on the Lake Shore in one year it rose from $1.63 to $2.10 —nearly 30 per cent. increase. The use of fuel oil in California and Arizona has greatly reduced the expense of steam generation, although in order to gradually charge out the cost of the properties, the price of the oil has, in some cases, been maintained at quite a high figure; for instance, while actually costing about $1.50 a ton to produce (equivalent in heat to 1½ tons of coal, or nearly two tons of lignite) it was charged to locomotives at $4.00.

These variations show how extremely difficult it is to make intelligent comparisons of fuel cost on any unit basis, for different roads or different divisions of the same road, even without considering the physical characteristics (which will be taken up later), and also for the same division during different periods of time.

Hauling.—The prices just given are usually those paid for coal either at the mine, when adjacent to the railroad consuming it, or delivered on the line by some other railroad, at its nearest point to the mines; in either case, it must be hauled to the distributing points throughout the length of the road, and there is generally no charge made for this service, such as an addition to the price of the coal at the mines to cover the expense of this haul. Company's property is ordinarily hauled without any specific charge being made for the same, but nevertheless, it costs money to transport it, and in estimating upon the comparative value of different fuels, this should be remembered. It may not be clear just what is the proper charge to place upon such transportation, as it is possible to consider the problem in a variety of ways. Unless the quantities of fuel to be hauled constitute a large proportion of the traffic, it is clear that superintendence, maintenance of way and structures, station service and miscellaneous contingencies will only be imperceptibly increased, if at all, by such additional tonnage, and that engine service, train service and maintenance of equipment will be the only accounts which will be actually increased. That is, if such hauling was not done, charges first mentioned would still be as great, and would have to be pro-rated over the revenue ton mileage or train mileage. Cases occur, however, where such tonnage is a very large proportion of the total traffic, as for instance during a coal strike and water famine, which occurred together in the southwest, when the fuel and water hauled amounted to 60 per cent. of the total tonnage transported over a portion of the line. Under such circumstances the revenue freight would have had to stand very large charges for superintendence, etc., if it were not pro-rated uniformly over all the traffic. The fairest method is probably to charge the full proportion of operating expenses to such freight based on a net ton-mile distribution, although it certainly does not increase the cost of operation (usually) by this amount. The actual sum is specified by the proper accounting officer, based on certain rules which have been laid down, and the operating expenses for the preceding month or year. Its value is likely to fall between ¼ and ½ cent per ton-mile, although even this is susceptible of different constructions. For instance, on a large system in the west, the average cost of operation for March, 1903, was .41 cent per ton-mile net, while certain main line divisions ran .32 cent, and certain branches, where traffic was light and grades severe, 2.81 cents per ton-mile net. The principal coal carrying branches cost about ½ cent per ton-mile, which it seems would in this case be the proper charge to add to the "mine cost" of the fuel. Thus every hundred miles that it was necessary to haul coal from the point of delivery to the chutes increased its cost 50 cents a ton, as a matter of actual fact.

Handling.—This constitutes another charge against locomotive fuel. It may be included in the stated cost, or it is sometimes charged to a separate account. In any event, it increases the cost to the locomotive by an amount depending entirely upon the methods in vogue. At a recent convention of the Association of Railway Superintendents of Bridges and Buildings, the various methods of handling coal were stated to cost approximately as follows:

METHOD OF HANDLING.

	Cost, cts. per ton.
1. Shoveling from railroad cars to tenders	25
2. Shoveling from cars to high platforms and again shoveled on to tenders	25 to 50
3. Crane and bucket from storage platform	35
4. Shoveling from cars into bins from elevated trestle	10
5. Dumping from railroad car directly into bins	1½ to 3
6. Hauling railroad cars by cable up steep incline and dumping directly into bins	3
7. Dumping from railroad cars into pit and elevating by conveyors	3
8. The same as above, but elevating by air hoist	5 to 10
9. Locomotive crane working from stock pile to bins or to tenders	1¾
10. Dumping through trestle to platform and tramming and dumping into tenders	10 to 15
11. Dumping into pit in track and elevating skip by switch rope by engine taking coal	5 to 10

These figures seem very confusing in a way, for, it may be argued, if coal can be handled for 3 cents a ton, who would think of paying 25 cents or more. But this statement does not tell the whole tale. It is apparent at first sight that the cheaper methods of handling require a more costly plant and a correspondingly greater investment. Now in railroad accounts interest on the original cost of a plant is not usually included in the operating expenses, as it is covered by bond issues bearing stated amounts of interest, constituting "fixed charges," or by dividends on the stock. Nevertheless, it is an expense, as, perhaps, bonds must be sold that bear 4 or 5 per cent. interest to pay for the improved facilities.

Depreciation likewise is not charged, except in a way by replacement funds, but it exists and must be accounted for. If now we assume interest on investment at 5 per cent. and depreciation at the same rate, we would not be justified, from a financial standpoint, in erecting a modern coaling station, unless sufficient fuel were handled every year at such a station, so that the saving in cost of operating the plant would at least be 10 per cent. of the increased investment. There are many points on a railroad where a few engines only need to be coaled, and it is this very consideration that often accounts for antiquated and expensively operated (on the ton basis) coaling plants on important roads. Then, too, it is sometimes impossible to obtain the authority and funds to make much needed improvements at even important points, where large numbers of engines are coaled every day, and thus the cost of fuel as delivered to the engines is much greater than would appear at first sight.

Loss.—But there is still another increase which is often made in the fuel accounts, and this is due to "loss or shrinkage" from various causes. At times the improper handling of accounts causes a shortage in the fuel account. When the stock is inventoried, and in order to square up this account, either short weight is delivered to the engines, or the price increased, to take up the deficit. The result is the same, in either case—you cannot cheat the firebox, and if 1,900 lbs. are placed on the tender *for a ton*, you will still only obtain steam due to 1,900 lbs. of coal. It seems as if the fairest way was simply to raise the charging-out price sufficiently to close the deficit in a reasonable time; as this does not interfere with the enginemen's coal records. The writer remembers one case where the engineers and firemen were being interviewed regarding the increase in coal consumption per ton-mile, and finally one of the men stated that at a certain coal chute, but 1,800 lbs. were being served for a ton. This was found to be true, and the investigation fell flat, as far as the men were concerned. On another road, a large shortage had occurred in the fuel accounts during a previous administration, and for several years short weight tons were served all over the road, until the shortage was extinguished. This, perhaps, prevented making difficult explanations, but the result was the same—and the engines stood the "brunt of the battle," as usual.

It is quite common for large piles of soft coal to catch fire spontaneously, and many tons will be destroyed, besides the expense of removing the burning and charred coal, which is about the only way that such a fire can be conquered. It is a good plan to separate large piles by masonry walls, and to avoid stacking it much over 8 ft. in height. It has also been suggested that pipes be stood upright in the coal piles and at intervals thermometers be dropped to the bottom by cords, and then withdrawn, in order to see if a dangerous degree of heat has been generated.

When such losses occur, unless there is insurance available, the natural course to follow is either to raise the charging price (which is decidedly preferable) or to give short weight for a term, thereby invalidating the engineers fuel records, as compared with previous months, or with other divisions not affected by the loss.

Storage.—In order to protect themselves against traffic interruptions due to coal strikes, etc., many railroads store large quantities of coal at some point or points, more or less convenient. While there is seldom, if ever, any charge made for such storage, there is expense attendant upon the same. Facilities of some kind are needed, if nothing more than a track or trestle, and these mean an original outlay. In some cases, as the New York Central's storage plant at Syracuse, machinery is installed, involving quite an expense. Then the extra handling for unloading, and loading again for shipment to the chutes must not be forgotten. Cases have occurred where the reloading was done by a steam shovel, and while the cost of handling was small, there was a great quantity of stones and natural soil picked up by the dipper, which finally found its way into the tenders, causing failures for lack of steam and general complaints, both by despatchers and enginemen. Again, many coals when stored upon open ground, are very unfavorably affected by the weather, and depreciate greatly in heating value. Much of the lump goes to slack, and if needed for passenger service, coke-forks must be used, sorting out the lump for the most important trains, and allowing the freights and switchers to struggle along with the fine stuff. This means a double loss—the extra labor involved in preparing and

loading the coal, and the poor steam making qualities of the refuse. But when a shortage in fuel occurs everything must be done to keep trains moving, even if an increase in expenses be caused thereby. Such cases are by no means rare, as the writer has passed through a number of such experiences.

When oil is used as fuel many of these troubles are obviated, but others crop up. All shipments of oil contain more or less water—sometimes *more than less*. The continual filling of storage tanks from tank cars, and the accumulation of considerable quantities of water therein at times result in undue quantities of water being found in the tender oil tank. Cases have occurred where the burner would not start, and upon investigation it was found that water was flowing to it instead of oil. All tender oil tanks have drain cocks at the bottom for the purpose of removing this water, but it is bought and paid for as oil, and increases the cost of fuel accordingly. Tank cars are often found to contain quite a depth of sand or deposit at the bottom, and as the bills are rendered on the basis of measured capacity (or loaded weight less stenciled light weight) there occurs a shortage which must be made up in some such manner as previously indicated.

We see from this category of possible expenses that it is really quite a difficult matter to determine the *exact cost* of fuel delivered upon the tenders, and that the billed price of the coal conveys but little idea of the real cost. If we desire to know the number of heat units produced in the firebox for every dollar spent upon the fuel, which involves definite information regarding the quality and composition, we have a task infinitely more difficult, unless actual tests and analyses are conducted with samples from each tender load, and yet the largest item of operating expense is dependent upon just this specific combination of cost and quality, and every official, from the general manager to the road foreman of engines, is constantly studying and answering questions regarding a variation of a fraction of a pound of fuel or of a cent in expenses per 100 ton-miles of movement!

(To be continued.)

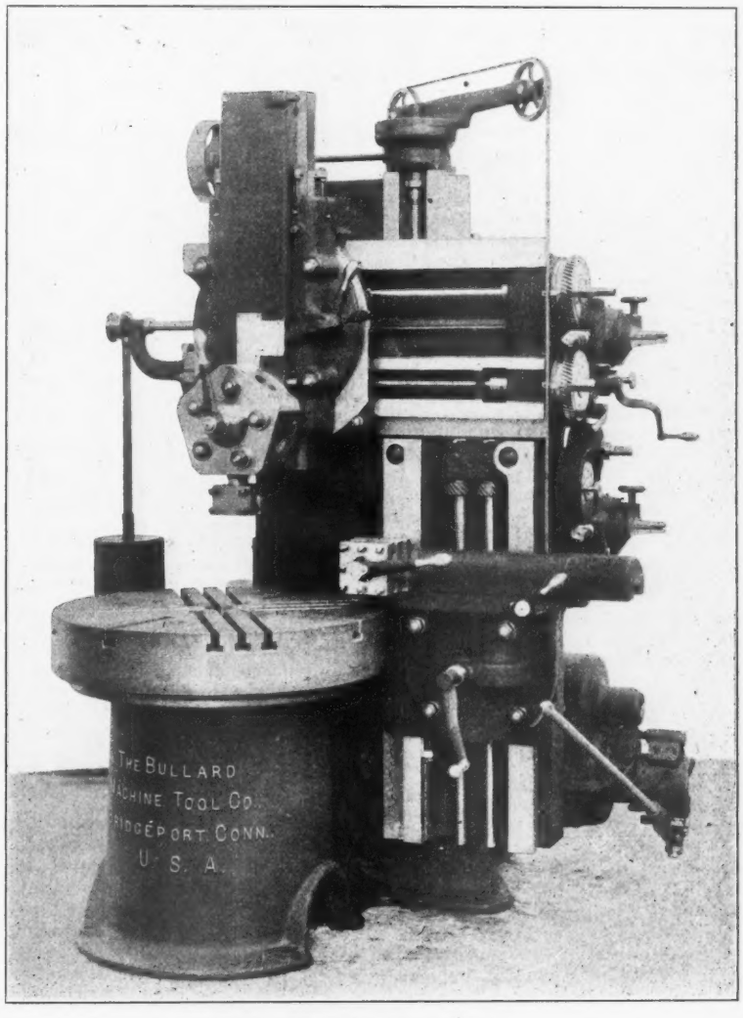
The Bullard 36-in. Vertical Turret Lathe.

For handling heavy face-plate work the vertical mill, or lathe, is gaining in popularity. Not only is a more rigid frame, or bed, permissible in this construction than can be obtained in a horizontal face-plate lathe, but the added weight of the work resting directly on the spindle thrust bearing tends to preserve the alinement. There is also freedom from chatter and vibration in the vertical type, as compared with the horizontal, which can be readily appreciated when the heavy overhanging parts of the latter are considered. This point of overhang is one of the strongest arguments in favor of the mill, as the time, which in the lathe is consumed in setting a heavy overhanging piece, is, in the mill added to the actual time in which the machine can be cutting.

The accompanying illustration shows a 36-in. vertical turret lathe made by the Bullard Machine Tool Co., Bridgeport, Conn. This tool will machine work 36 in. in diameter x 24 in. high. The table is 34 in. in diameter, and is driven by an internal spur gear. The table spindle has a self-centering tendency due to large angular thrust bearing; side strains being taken by straight vertical bearings of large proportions. The table has 15 changes of speed, ranging in geometrical progression. These are mechanically obtained from a single speed driving pulley through a speed box containing self-adjusting friction clutches. The speed changes are obtained by a lever, which is placed convenient to the operator. The table can be stopped instantly at any desired point by means of a brake, which is operated by lifting the speed lever. The cross and side rails are a unit, and have a vertical adjustment of 12 in. by power.

A narrow guide bearing is provided for the saddles which prevents the tilting and binding of the heads. There is one vertical and one side head. Each is entirely independent in its movements, both as to direction and amount of feed, and when desired both heads may be operated jointly on work of small diameter, as the heads are arranged so as not to interfere with each other. The vertical head will face 36 in., and has a vertical and angular movement of 26 in. It may be set to an angle of 45 deg. either side of center. The turret slide is square locked throughout. No loose gibs are used and all adjustments for wear are made by taper wedges. The turret has five faces, the inscribed circle of which is 10 in. in diameter, and the holes therein are 2½ in. in diameter. The turret faces are square with the table, and tapped holes are provided for attaching special tool holders. The binder plugs in turret have a double grip on the tool holder shank. The side head has a vertical movement of 28 in., and a horizontal and angular movement of 15 in. It may be set to an angle up to 40 deg. either side of the horizontal. A four-faced turret tool-holder is provided on the side head.

When desired the side head can be left off of the machine, in which case the capacity of the machine is increased to 41 in. in diameter. The feedworks for each head are entirely independent, and are conveniently placed for operation. The feeds for both heads are positive and have eight changes, ranging from 1/90 to ½ of an inch in all directions. The feed changes are instantly obtained by turning a star wheel; and the amount per revolution is indicated on direct-reading index-plate on each feed box. Change from vertical feed to cross feed, or vice versa, is obtained by engaging a centrally located drop worm with worm gears on the end of the feed rods.



The Bullard 36-in. Turret Lathe.

A safety device, which prevents the breaking of the gears or mechanism by careless handling of the heads, is provided in the feed works. All gears are incased and run in a bath of oil, and all of the journals are bronze bushed and self-oiling.

The driving pulley is 24 in. in diameter, for 4 in. double belt. The countershaft has one tight and one loose pulley, 14 in. in diameter, for 4½ in. belt, and should run at 420 r.p.m.

When it is desired to drive this machine by motor a 7½ h.p. constant-speed motor is recommended. This may be mounted on a bracket at the side or the rear of the machine and connected by either belt, gearing or chain. A thread-cutting attachment for

the vertical head can be fitted if desired. The net weight of machine is 9,300 lbs., and the total floor space required is 65 in. x 70 in. The machine being self-contained, and no expensive foundation is required.

The Trans-Siberian Railroad in War Time.

Collier's Weekly contains the following account of the working of the Trans-Siberian Railroad during the war, written by Prince Khilkoff, Russian Secretary of State and Minister of Ways and Communications.

The Trans-Siberian Railroad has successfully met the severe strain which the war has imposed upon it, and it will continue to do so. At the outset of the war, many of our foreign critics predicted that it would break down; that it could not possibly transport the troops, their impedimenta and supplies, which would be necessary to enable us to defeat our enemy. How their prediction has been fulfilled is shown by the result. We have transported to Manchuria up to this time about 300,000 men; we are now transporting about 400,000 more. We have been sending hundreds of guns, thousands of horses, and countless tons of ammunition and supplies. We have conveyed all the Red Cross offerings, hospital equipment, lumber for barracks—everything in fact that an army requires. At the same time we have carried freight for the inhabitants of Siberia, to whom the railroad is a vital artery.

How has this been accomplished? Many who knew that we had only a one-track line, 5,000 miles in length, were astounded. This single steel rail, that binds the Russian force in the Far East to the parent country, seems the weakest link in our armor. But I believe that those who look for Russia's discomfiture because of inability to get men to the front and to supply them will be disappointed. When I built the railroad, I thought: "We may have need for this some day." People said that there would be little traffic upon it. I thought differently. I felt that the railroad would develop the country; that the commerce which a vast and growing country demanded, and which only a railroad could handle, would steadily develop, and that a constant and increasing strain would be put upon the line.

When war came near we appreciated in St. Petersburg that the railroad would be put to a very severe test. We did not have enough sidings to insure the prompt passage of trains. It was, of course, important that the cars should come back from the east, for they were needed not only for the wounded and to bring supplies waiting along the route to European Russia, but to return with reinforcements and supplies. So I started for Siberia last winter, impressed with the necessity of building additional sidings immediately. In the first nine months of the war we built and put into operation 200 of these sidings. The magnitude of this work will appeal to any engineer. Besides constructing these sidings, I hastened the completion of the railroad around the great Lake Baikal. Personally I did not see the need of this branch. We had on the lake two ice breakers, one of which is American in thought, in design, in everything, in fact, save construction, for it was built in England. It is similar to some of the big steamers you have on the Great Lakes. It can make four round trips a day. On the lower deck on each trip it can carry 28 wagonloads of supplies; on the main deck 2,000 men, and on the upper deck 300 horses. The other ice breaker is smaller and is used as an auxiliary. For five years these ice breakers have handled the traffic of the railroad without a hitch. They could have continued to do so without difficulty. But the military thought it advisable that there should be not a single break in the line, and to meet their wishes I built the circum-Baikal branch. The distance across the lake is only 25 miles; the length of the circum-Baikal line is 125 miles. It was a difficult work. We had to build 40 tunnels; we had to cut the rock down in some places in order to form the roadbed. It was a hard job, but we finished it, and the road is now in operation.

The railroad was originally built for seven trains each way per day. The roadbed and the rails could have stood a heavier traffic, but the comparatively few sidings limited the number of trains. Every siding added to the transportation capacity of the road.

Around the circum-Baikal line we can run an average of 16 trains each way per day; on the rest of the line the same average is maintained. We will be able to get up to 18 trains each way per day. That will be the limit for a single-track line. Of the 16 trains, 13 are military. Only six transport troops—each train can carry about 800 men—the remaining seven are loaded with horses, guns, supplies, etc. If we had a double track the whole traffic problem would be solved. The expense of operation would be materially reduced also. For instance, on one section of the line we have to use to-day 1,250 engines. If a double track existed we would need only 800 engines. One difficulty we have had arose through lack of trained engineers and firemen. The experience the men have been getting since the war began has resulted in an increased force, and now we will soon have enough men to meet the situation. We have had to increase the rolling stock of the Trans-Siberian line. This has been done by requisitioning engines and cars from European Russia. About 10 per cent. has been taken.

We have an ample quantity of fuel. At first we used wood, but now we burn coal. A large quantity of the coal is brought from Newcastle. We are getting some poor coal along the line. In addition we are getting a large quantity of lignite. Of course, there is an immense amount of wood, and we will not suffer from lack of fuel.

Rails for Lines With Fast Trains.*

BY P. H. DUDLEY.

(*Continued from page 169.*)

Chapter 11 considers the use of nickel steel for rails. Only four roads replied as having nickel steel rails in track, the Pennsylvania, Baltimore & Ohio, Pennsylvania Lines West and the New York Central. The accompanying table gives the chemical composition of the rails furnished by the Carnegie Steel Co. to three of these roads which were made by the open-hearth process and by the Bessemer process as indicated.

	Penn. Lines West, open-hearth.	Pennsylvania, Bessemer.	Pennsylvania, Bessemer, 1903.	N. Y. Central Bessemer 1903.
Nickel	3.52	3.22	3.50	3.40
Carbon	0.53	0.50	0.42-0.52	0.40
Silicon	0.05	0.13	....	0.11
Manganese ..	0.80	1.00	....	0.79
Phosphorus .	0.14	3.09	....	0.09
Sulphur	0.02	0.03	....	0.04

The following is the record of the open-hearth rails laid on the Cleveland & Pittsburg Division in comparison with carbon steel rails by the Bessemer process laid under the same conditions: Nickel steel rails laid in November, 1897, on .4 per cent. grade. Bessemer rails laid in August, 1898, on .49 per cent. grade. Both on 4 deg. 42 min. curves.. Average speed of trains 44 miles an hour. Area of section worn off from surface of rail; Bessemer, high rail .58 sq. in., low rail .32 sq. in.; nickel, high rail .36 sq. in., low rail .28 sq. in.

The Bessemer nickel steel rails furnished to the Pennsylvania, which had an average composition as shown in the second column of the table, were of 100-lb. section and were laid on the Horseshoe Curve during the winter of 1899-1900. The lowest nickel content in these rails was 2.83 and the highest 4.32 per cent.; the lowest carbon was .419 and the highest .597 per cent. In July, 1902, Mr. J. T. Richards, Chief Engineer Maintenance of Way of the Pennsylvania, reported that the wear of these rails was very satisfactory. Since they were laid they had outworn two or three ordinary rails and were then only beginning to show signs of wear. He thought they would outwear four carbon steel rails. Some of the rails were, however, too hard and some breakages had occurred. On future orders he would recommend a lower carbon content. Subsequent orders for nickel steel rails for 5,000 tons of 100-lb. section and several thousand tons of 85-lb. section were furnished to the Pennsylvania by the Carnegie Steel Company and are now in service. These rails have a carbon content varying from .42 to .52 per cent. with 3.5 per cent. nickel. No reports have been received of the service of these rails.

Chapters 12 and 13 take up the subject of rail joints. The replies to the questions may be summarized as follows:

The ideal rail joint should perform the same functions as any other portion of the rail. In addition, it should maintain the ends of the rails in surface and line, preserve an even wear of the rail ends, ride smoothly, and provide for the necessary expansion or contraction due to extremes of temperature. It should be simple, of few parts, readily applied and maintained, durable and inexpensive.

The first condition is comprehensive and includes all that has been said of rails. The rail joint forms the continuous line of the superstructure of the track and must do its important share of continuing the "general depression" under passing loads, carrying and distributing them.

The trackmen, when using either the system of alternate or of opposite joints, with unequal crosstie spacing, can surface and aline the rails to the satisfaction of the most critical supervisor. The uniform depression of the rails, crossties, ballast, and subgrade, under the moving loads of the locomotives and cars, is more difficult, however, and can only be accomplished approximately by the best of joints, though some are more effective than others.

The efforts to secure the ideal rail joint are evident from the diversity of practice. A stremmatograph record of the functions the rail performs under a moving locomotive, shows that there is a series of alternating stresses of compression and tension for each passing wheel. The joint to perform similar functions must be able to continue through the splice bars, part of the horizontal components of strain from one rail to the next under a wheel or in the wheel spacing of the passing locomotive or car. The splice bars by fitting tightly to the inclined surfaces of the head and base of the rail, are able, by their friction, to transmit the wave and a portion of the horizontal strains from one rail to the next. This is considered possible by a majority of the replies and has been proved by actual tests, which must be the case theoretically and practically, in order that the joint may ride as smoothly as any other portion of the track.

A well fitting splice bar for a 5-in. rail requires over 4,000 lbs. per lineal inch of one-half of the length of the bar, to overcome the friction in the rail ends, before it

*Abstract of a report to be presented to the International Railway Congress to be held in Washington, D. C., May, 1905.

will render, due to temperature changes. In a 40-in. bar this would be 80,000 lbs., practically, before the splice bar would render under the passing wheel loads. This is sufficient to continue large horizontal components of strain from one rail to the next. Short bars, which would render under less strains, cannot be as efficient, and deteriorate faster under service. Splice bars for 90-lb. rails have a resistance for one-half of the length of nearly 4,500 lbs. per lineal inch, while those for a 6-in., 100-lb. rail should be over 4,800 lbs. per lineal inch.

In studying the wear of the splice bars, it has been found that the short bars 20 or 26 in. long wear rapidly on their upper and lower surfaces between the ends of the rails and the nearest bolt holes, then the rate of wear decreases until nearly the last bolt hole, then it increases to the end of the bar. While the same form of wear is found on the longer bars, 36 to 42 in. long, the rate of wear is less rapid. The long bars wearing less rapidly, can be kept tight by the trackmen, and are able to transmit the horizontal components of strain for a longer service than is the case with the shorter bars, which are not as efficient when new, and deteriorate more rapidly. Splice bars for long service must provide for wear, oxidation and compensation.

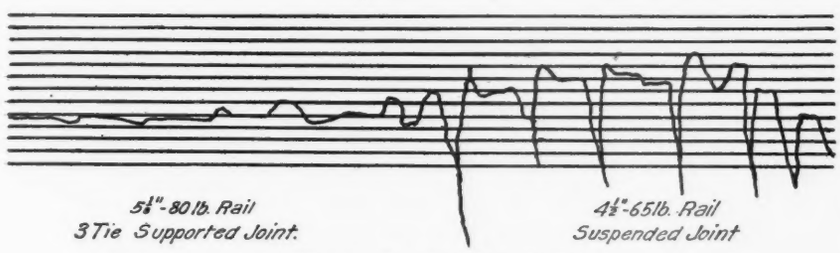


Diagram from Track Indicator.

It has been found from the extensive experience of the use of the three-tie joints on the New York Central, that to cause the rail to wear evenly, the splice bar must have high physical properties, and a wide head. While it is the general experience that our recent heavy rails, carrying the present wheel loads, have worn faster than the early 4½-in. rails, under light loads, it must be remembered that with all of the desirable qualities of the small rails, the joints were so inefficient that the facing ends cut out rapidly, the joints were always low and the track rough. With a high grade of steel, broad heads and three-tie joints, the wear of the facing ends of the rails is so even and uniform, compared to that of the trailing end, that after eight and nine years' service under a daily tonnage of 100,000 to 125,000 tons, the rail ends are uninjured, practically, and not worn more than the other portions of the rail.

The ordinary splice bar has as few parts as any of the joints reported. The neutral surface of these bars being but slightly lower than that of the surface of the rails, the continuity of the wave of one rail is transmitted in the "general depression" to the next without much interruption or augmentation. They are applied easily, and when provision is made to take up the wear with sufficient length, and are rolled out of a high grade of steel, they are of reasonable durability and are inexpensive. For the splice bar to be satisfactory, it is essential that it should be rolled from metal having high physical properties. It is important also that the web of the splice bar should be comparatively thin, so that it can be drawn up under the head of the rail, as wear takes place. Thin bars can be stamped from a high grade of metal.

The subject of supported joints is considered in Chapter 13. Only three roads reported having made experiments with three-tie supported joints, the Illinois Central, Burlington and New York Central. The Boston & Albany and the Lake Shore have made experiments with a single tie supported joint and the former is now using some three-tie joints with 36-in. splice bars. The experiments of the New York Central have shown the decided superiority of supported joints when put up with high carbon steel splice bars having an elastic limit of 50,000 lbs. With well finished joints of this type, the ends of the rail and the splice bars form a simple beam and do not act as cantilevers after the splice bars become slightly worn as in the case of suspended joints. The accompanying diagram taken by the author's track indicator shows the difference in riding qualities of the track when passing from 4½-in., 65-lb. rails with suspended joints to 80-lb. rail with three-tie supported joints.

(To be concluded.)

Automatic Couplers in Europe.*

BY G. NOLTEIN.†

(Continued from page 150.)

The question of automatic couplings for passenger cars is quite different from that of couplings for goods wagons. On the one hand, as there are fewer vehicles and they are generally used in made-up trains requiring no complicated shunting operations, the change can be effected with much less difficulty. On the other hand, the existing couplings are so poor and so unsuitable for passenger cars that their use on modern rolling stock is warranted under no conditions. Screw couplings in addition to their well-known disadvantages as far as safety of employees is concerned, are in no way adapted for the special conditions involved in passenger train service. The trains are run at high speed with short stops at stations which allow but little time for adding or detaching cars or for coupling up sections coming from different directions. The principal disadvantages of the existing screw coupling under these circumstances are as follows:

1. If the couplings are screwed up tight, so that the buffer springs are compressed to a certain extent, this assists the smooth running of the carriages, as the friction between the faces of the buffers opposes oscillations of all kinds as well as sideway movements. But this method of obtaining smooth running only attains the desired object in a primitive and incomplete manner.

2. A condition which is essential for the safety of the passengers is to prevent as much as possible the vertical displacement of each carriage relatively to the adjoining carriages. The first condition necessary to enable a carriage to resist the violent shocks produced in case of accidents such as derailment, collision, etc., is that the underframe should have a sufficient number of strong longitudinal beams extending along its whole length. It will never be possible to build a carriage body of a strength approaching that of the underframe. It is, therefore, very important to prevent as much as possible any relative displacement in the ends of the underframes in order to prevent the underframe end from crashing into the nearest carriage body, or, as it is sometimes called "telescoping" a car. It is, however, quite evident that the present form of screw coupling in no way prevents the relative movements of the ends of two wagons in contact. The buffers appear to be devices specially designed to guide the underframes into the bodies of the wagons behind and in this way to render every accident more disastrous. For as the axes of the rods of two buffers in contact are hardly ever in the same straight line, the rods are easily bent and thus in case of a collision they form inclined planes which force each underframe on to or under the adjoining one and thus they contribute to the destruction of the bodies.

3. When much space is left between the carriages, the gaps have to be bridged over with long and inconvenient footways protected by railings. If vestibules are provided, they are long and costly and subject to considerable wear, as they have to follow all the relative movements of the carriages.

4. The drawsprings as well as the springs of the lateral buffers being comparatively easily compressed, the wagons of a train form masses which are capable of considerable relative movement in the direction of the length of the train. When independent drawbars are used, the compression of the springs can increase and decrease the length of the train, but when continuous drawbars are used the length of the train cannot increase by more than the travel of the one drawspring, and the reactions due to the extension of springs compressed by any cause can produce considerable shocks and even cause train breaks.

All of these disadvantages are overcome in the arrangement in use on American railroads known as the platform equipment and this arrangement has been applied to the new passenger cars on the Moscow-Kazan Railway after investigation had shown that no satisfactory solution was possible by retaining the European form of coupling. The arrangement used on these cars is a slightly modified form of the Buhoup three-stem equipment, the necessary modifications being made to fit both the drawgear and the buffer plate springs in the central plane of the underframe. The distance between cars has been reduced to $11^{11}/_{16}$ in. in this way.

Springs of the same dimensions and capacity as those used in America have been supplied. The two buffer plate springs exert a force of 4,850 lbs. at the moment the coupler knuckles are closing into each other. The travel of the head is 2 in. and when at the end of its travel the draw springs and the buffer plate springs together exercise a force of 41,965 lbs. whereas the springs of two ordinary buffers have a resistance of only 12,000 lbs.

When the train runs around a curve, the axes of every two consecutive carriages form an angle which depends on the radius of the curve and on the distance between the carriages, center to center. The stress on the two buffer plate springs, therefore, is different on the two sides of the carriage and produces a twisting moment which results in an injurious extra pressure between the wheel flanges and the rails. But as the distance between the centers of the buffer plate springs in the platform equipment is always much less than that between the centers of the ordinary buffers, the numerical value of

*Abstract of a report to be presented to the International Railway Congress to be held in Washington, D. C., May, 1905.

†Member of the Managing Council of the Moscow-Kazan Railway.

this twisting movement is appreciably smaller than that induced in carriages with the common form of coupling. On a curve having a radius of 528 ft. the twisting moment is 4,419 ft.-lbs. for a car with platform couplings, whereas it amounts to 6,061 ft.-lbs. in the case of cars of the same size but equipped with side buffers.

The equipment described is at present fitted to ten cars on the Moscow-Kazan Railway, eight of which are intended to form a long distance through train and two to be held in reserve. This train was put into service last fall. In order to make it possible to use these cars with American couplings in trains with cars having European couplings each car can be changed in about 20 minutes by making the following alterations:

Putting side buffers in place.—The cars have the ordinary buffers fitted in special cast-steel buffer boxes which are strongly hinged along their lower edge to the bottom of the outside face of the end sill. When the American couplings are in use these buffers are turned back under the end of the car and hung from a chain and hook fastened to the underframe. To fix the buffer in its normal position it is unhooked and swung up into a horizontal position with the back of the buffer box bearing against the face of the end sill. By inserting and tightening two bolts along the top edge of the buffer box it is held firmly in position.

Putting drawhooks and screw couplings in place.—Each car carries two drawhooks having tails which fit into the head of the Janney coupler when the knuckle is removed and are held in place by the knuckle pin. The hook occupies, relatively to the side buffers, exactly the same position as in the normal European coupling, and when so altered the car will couple and uncouple the same as any other car without platform equipment. The usual screw coupling chains are carried to connect the drawhooks.

Putting footway in place.—Because of the wide separation of the cars when the side buffers are in use a footway or gang plank must be put in place to bridge the opening. This footway is a steel plate hinged at one end to a bracket which is bolted on the face of the buffer plate by four bolts when changing a car for European couplings.

The drawhooks and footways are carried in a box hung under the underframe of the car. In order to make it possible to add ordinary carriages to the train and to attach locomotives having no transition couplings, the two ends of the train are always arranged for European coupling. It is understood, of course, that this type of coupling and platform can only be adopted for new equipment. For changing old cars the type of automatic coupler without buffer plates such as is used for freight cars (see previous article) will be used.

The advantages of using automatic couplers for passenger cars may be summed up as follows:

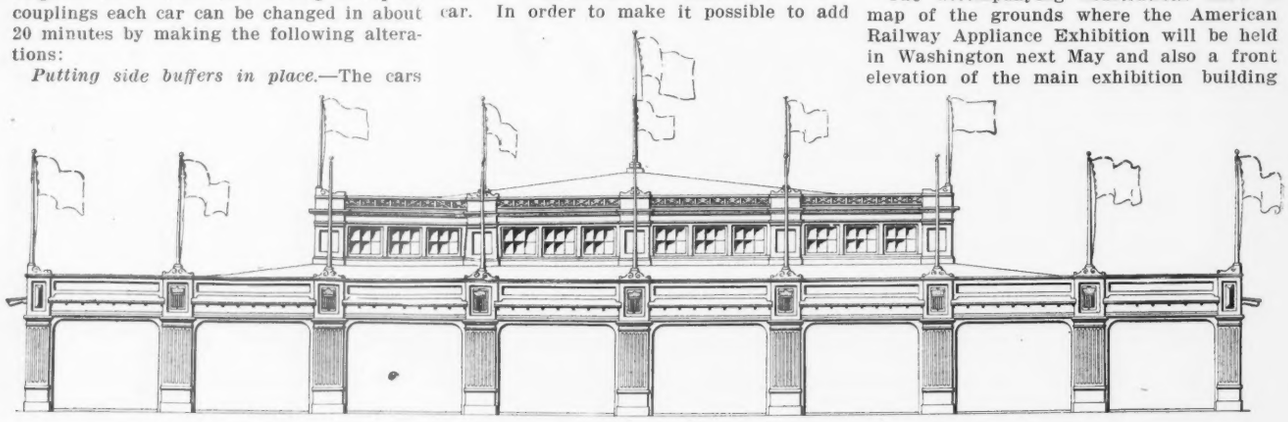
1. In the case of passenger cars the question of the application of American couplers seems to be easier to solve, as their number is much smaller than that of goods wagons, and the service is much more regular.

2. The transition systems examined for goods wagons are equally suitable for carriages. But any arrangement with considerable overhang is not to be recommended.

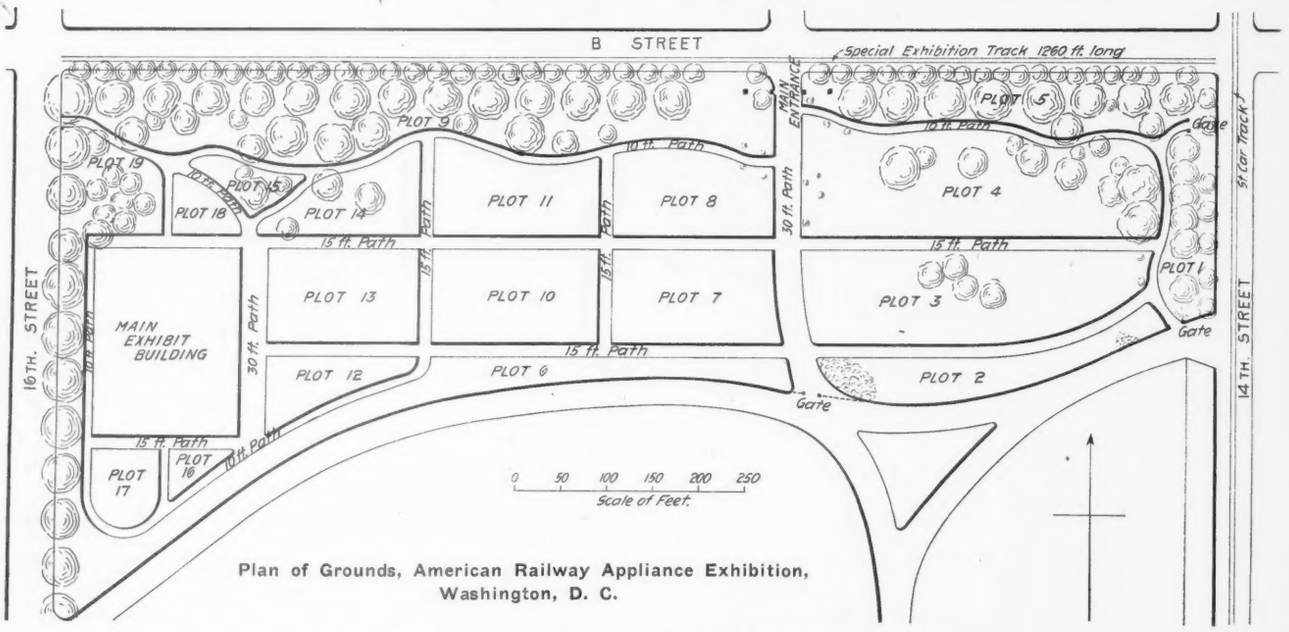
3. In the case of new carriages, equipment with spring vestibules offers essential advantages from the point of view of safety. It makes the carriages run more smoothly, it counteracts any shocks due to badly adjusted continuous brakes and offers certain guarantees in case of accident.

The American Railway Appliance Exhibition.

The accompanying illustrations show a map of the grounds where the American Railway Appliance Exhibition will be held in Washington next May and also a front elevation of the main exhibition building which will occupy a space 160 ft. x 200 ft. in the west end of the grounds. The main entrance to the enclosure will be on B street opposite Fifteenth street, but there will be four other gates as well. The grounds measure approximately 1,250 ft. x 375 ft., and this space will be divided by 10-ft. and 15-ft. paths into 19 plots of odd sizes and shapes for the accommodation of large outdoor exhibits and special booths. A special exhibition track 1,260 ft. long will be built along B street for storing exhibits of cars, locomotives, etc. The main exhibition building will be one story with a high roof over the center. Frank H. Jackson, of Washington, is the architect for the building, and Samuel J. Prescott & Co. are the contractors. W. A. Cattell, of New York, has been retained as consulting engineer in charge of all arrangements for buildings, heat, power, light, etc.



Elevation of Main Exhibition Building, American Railway Appliance Exhibition, Washington, D. C.



Plan of Grounds, American Railway Appliance Exhibition, Washington, D. C.

GENERAL NEWS SECTION

NOTES.

A Chicago paper says that the Great Northern has taken 15,000 tons of rails from Chicago to the Pacific Coast at 20 cents per 100 lbs., the rails being destined for Japan. This is at the rate of about 1.8 mills per ton per mile.

The St. Paul Union Depot Company established a bureau of information at its union station a short time ago. We are informed that the wisdom of the action has already been proved, and that the relief afforded the revenue producing offices promises to eclipse the primary object for which the bureau was established, namely, affording reliable information to the traveling public.

Among the original ideas in legislation laid before the New York State Assembly at Albany at the present session is an act to prevent discrimination against passengers in local trains by delaying such trains for the purpose of giving through express trains the right of way over them. The penalty proposed is $50 to each passenger delayed. This proposition comes from "commuters" in Yonkers.

At one of the congressional committee hearings on the "private-car evil," George B. Robbins, President of the Armour car lines, said that the number of cars owned by his company was 14,000 and that the capital representing them was $15,000,000. He said that a million a year was spent on new equipment. Of the cars owned by the company 8,000 are used in the fruit trade and the rest for meats, butter and eggs.

New Hall Signals.

The Hall Signal Company has taken a contract to equip with automatic block signals the line of the Chicago & North Western between Milwaukee, Wis., and Lake Shore Junction, about 10 miles. This is in addition to the contract for 31 miles reported before. The signals are the Hall enclosed disk pattern.

Bids for Gun Forgings.

Bids were opened last week at the Navy Department for 100 sets of 3-in. gun forgings. The bidders were the Crucible Steel Co., the Midvale Steel Co., the Bethlehem Company and the Driggs-Seabury Ordnance Corporation, the last named being the lowest bidder by from five to eight cents a pound with deliveries more advantageous for the Department. The value of the contract will be about $60,000.

New Reading Coal Storage Plant.

The Philadelphia & Reading Coal & Iron Company has given a contract to the Link-Belt Engineering Company, of New York, for the construction of the largest coal storage plant in the world. The plant, which will have a capacity of more than half a million tons of coal, will be located at Abrams, on the main line of the Reading road, near Bridgeport, Pa., and will have railroad frontage of a mile. It is to consist of eight piles, and each at its maximum will aggregate 60,000 tons, with a receiving capacity of 14,000 tons in 10 hours, and a discharging capacity of 10,000 tons in the same time.

Treated Ties on the Santa Fe.

E. O. Faulkner, Manager of the tie and timber department of the Atchison, Topeka & Santa Fe, has issued the annual statement of treated pine ties laid and removed, the report being for the lines east of Albuquerque, N. Mex. The total number laid was 1,913,937, the largest number yet put into the track in one year, and exceeding 1903 by 567,886. None of these were removed on account of decay but 1,654 were taken out for other causes, leaving 1,912,283 still in track. The total number of treated pine ties that have been laid by the Santa Fe to Dec. 31, 1904, is 10,982,042. No record of removals was kept prior to March, 1897. The total number of treated ties laid from 1897 to 1904 inclusive was 8,453,296. The total number removed is 108,558, of which 77,415 were on account of decay and 31,143 from other causes, leaving still in track Jan. 1, 1905, 8,344,738. The percentage still in track of each year's ties from 1897 to 1904 are: 91.78, 94.7, 97.83, 99.3, 98.89, 99.51, 99.75, 99.91. The average life service of the treated ties has been 10.66 years.

Air Compressors for the Hudson River Tunnel.

The contract for the compressed air power plant, to be used in driving the second pair of trolley tunnels under the Hudson River, has been awarded to the Ingersoll-Sergeant Drill Co. These tunnels, which are popularly known as the Cortlandt Street Tunnels, for the reason that their New York terminal will be located on that street, are to be built by the Hudson Companies, of which Mr. Chas. M. Jacobs is the Chief Engineer. The shield method of subaqueous tunneling will be used. The order includes five duplex air compressors. Three are low pressure Class "H" machines with steam cylinders 14 in. and 28 in. in diameter, air cylinders 22¼ in. in diameter and 16 in. stroke, with a maximum air pressure of 50 lbs. per sq. in. and a capacity of 1,850 cu. ft. of free air per min. each. The other two are Class "HC" machines for high pressure, with steam cylinders 14 in. and 28 in. in diameter, air cylinder 24¼ in. and 14¼ in. in diameter and 16 in. stroke, with a maximum pressure of 125 lbs. per sq. in. and a combined capacity of 2,000 cu. ft. of free air per min.

Edward Longstreth.

Edward Longstreth, until 1886 one of the owners of the Baldwin Locomotive Works, died in Philadelphia, February 23, 65 years old. Mr. Longstreth was a descendant of Bartholomew Longstreth, who came from Longstreth Dale, Yorkshire, England, and he was born on the Longstreth homestead in Bucks County, Pa. He began a five years' apprenticeship at the Baldwin works in 1857 and before four years had elapsed he had become a foreman of one of the shops. He exhibited energy and studiousness and developed great inventive ability. He developed and perfected the gage system which is now the characteristic feature and a most important factor in the success of the Baldwin works. In 1867 he was made general superintendent of the works, and in 1870 he became a partner, retaining entire control of the mechanical and construction department with a force of 3,000 men. He was the youngest and one of the most important members of the firm. He retired from business in 1886 with impaired health. His fortune made in the locomotive business had been increased by judicious investments. He had been a vice-president of the Franklin Institute and held official positions in various financial institutions. He was a Quaker, and his funeral was conducted according to the Quaker ritual.

New Railroad in Baden, Germany.

Verig & Co., of Berlin, have just completed a railroad leading into the Black Forest. The road leaves the Offenburg-Konstanz line at the village of Biberach and terminates at Oberhamersbach, a distance of 6½ miles. The cost of the line, including rolling stock and improvements, was $297,500, or $45,769 per mile. The government of Baden granted a concession for 90 years, at the end of which time the line with improvements becomes the property of the Government, which also reserves the right to purchase the road at the expiration of 25 years. In that event it would be obliged to pay 25 times the net receipts of the road for the five years preceding the sale. By way of inducements to build the line the government donated $1,142.46 per mile, while the towns through which the road passes donated the right of way and gave cash donations besides.

The road was built by Italian laborers, who received 82 cents per day, the stone masons being paid but $1.42 per day. There are 20 sawmills and two large potteries along the line. The fare charged is: Second class 20 cents, round trip, 29 cents; third class 13 cents, round trip, 20 cents.—*U. S. Consular Report.*

L. I. R. R. and the Public.

In justification of the recent increase of season ticket fares on the Long Island Railroad President Potter has printed explanatory letters in the New York daily newspapers. One of these is referred to in the editorial columns; the second is given below:

The Long Island Railroad is handicapped by the natural limitations of its territory. It serves a narrow island, 115 miles long, with no important connections at present except water connections at the west end of the system on the East River. Accordingly, principles applying to railways operated upon the mainland cannot be applied to its conditions.

Other railroads rely largely upon through passenger business, whereas the Long Island Railroad has no such traffic to increase its income, lower its operating expenses and aid in maintaining an efficient service for commuters. With a line only 391.76 miles long, it has as many passenger cars as the Illinois Central Railroad, which is 4,301 miles long. While the average run of its passenger trains is less than 24 miles, more trains enter and leave its Long Island City terminal than enter and leave the Grand Central Station of the New York Central Railroad over both the Hudson River and the Harlem Divisions.

The island has not as yet developed any considerable manufactures, and thus the railroad is cut off from the most important source of revenue—freight business. Other railroads secure the greater part of their revenue from freight, while this road is dependent almost entirely upon passenger business. On the six other railroads centering in New York, the freight receipts are about two and a half times the passenger income, while on the Long Island Railroad the freight receipts are less than half the passenger income. In other words, these roads receive two and a half times as much from freight as from passengers, while this road receives twice as much from passengers as from freight. (See *Poor's Manual*, 1904.) Nevertheless, the average passenger rate per

mile—including all commutation rates, as well as all other passenger receipts—on these six other roads centering in New York is 1.668 cents, whereas the average on the Long Island Railroad is only 1.44 cents.

A further consequence of its position as a railroad with only an East River entry for passengers, is the fact that its operating expenses are necessarily high, since its trains must always be practically empty in one direction or the other, according to the time of day. After securing every economy possible up to this time, passengers are still carried at less than cost. Whether the recent advance in rates will cover the present deficiency of income cannot yet be determined.

New Scherzer Rolling Lift Bridges.

During the past month Scherzer rolling lift bridges were completed at Eighteenth street, Chicago; South Michigan street, Buffalo, and Swale River, England, on the South Eastern & Chatham Railway. During the next few weeks two Scherzer bridges will be finished in Brooklyn, N. Y.

The double-track, single-leaf, long span Scherzer bridge recently completed for the Newburgh & South Shore at Cleveland, has attracted attention because of its simplicity and economy, and it is being duplicated by the Baltimore & Ohio at an adjacent site, where a center-pier swing bridge is being removed. Orders for a number of additional single, double and multiple track bridges of similar form have been booked by the Scherzer Company, for which construction contracts are to be let this year. The contract for the construction of the Scherzer bridge for the Buffalo & Susquehanna and the Pennsylvania Railroads at Buffalo has recently been awarded and work on it is now in progress. Work is also in progress on Scherzer bridges at 22d street, Chicago; Harrison street, Chicago; Flushing, Long Island; Genesee avenue, Saginaw; over the Suir river, Ireland; Spaarne river, Holland; Saugus river, Boston; Malden river, Boston; West river, New Haven; and at Cos Cob, Westport, and Stratford, Conn. Among the foreign contracts on which the Scherzer Company is now working is a large highway bridge across the Ekaterinhofka river, St. Petersburg; also a deck bridge of arched outline, forming the movable portion of a long bridge connecting Barrow-in-Furness with Walney Island, England.

Unification of German Railroads.

The idea of uniting all the railroads in Germany under one management appears lately to have gained ground. It will be remembered that Prince Bismarck desired to have the Empire both own and manage all the German railroads, but was prevented from accomplishing his desire by the southern German governments, which feared to give too great powers to the Empire and to Prussia. Consequently the German railroads were not purchased by the Empire, but by each German government individually, and those of each have been managed independently. This has caused great disadvantages to the German railroads, particularly to those of the smaller governments. An example of the waste of independent management is that whole trains of freight cars are often obliged to make long return journeys empty, because they belong to another government and therefore cannot be loaded. Complaints have also often been made against the Prussian government for favoring the railroads of one state to the detriment of those of another. It is said that Saxony has suffered in this way.

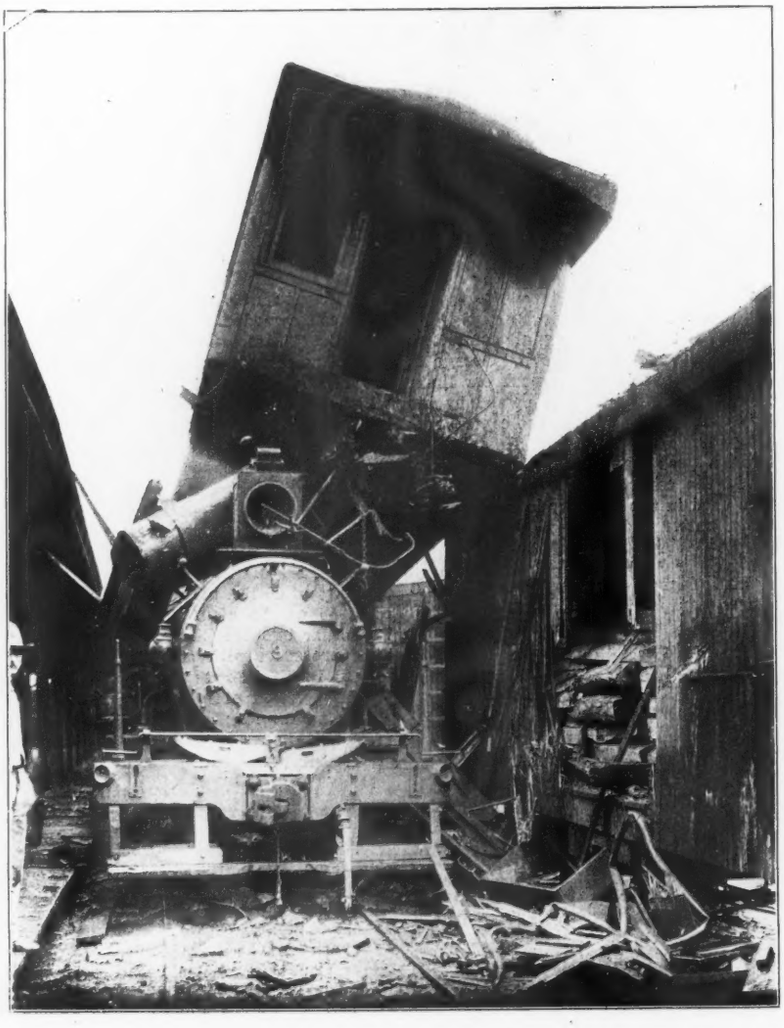
Of late years, owing largely to the commercial depression which Germany has been passing through, the railroads of the small states have not been giving good financial reports. Those of Prussia, however, on account of their great extent and excellent management, have stood the strain remarkably well. As it seemed hopeless to secure the railroads for the Empire, Prussia has for a number of years been trying to induce the other states to agree to some compromise which would secure the chief advantages of a united system while leaving the ownership to the various governments. A plan was proposed for uniting as many of the railroads as possible under one management without affecting their ownership, and allowing them also to retain, to a certain extent, their individuality and national character. Up to the present only the small Duchy of Hesse has actually made such an arrangement with Prussia.

Lately, however, the initiative in this matter has been taken by some of the southern German governments themselves, which called a meeting to consider plans for uniting the management of the German railroads. Accordingly, the railroad ministers of most of the southern German governments met at Heidelberg during this month, where the Prussian Minister of Railroads, Herr von Budde, joined them. The results of this meeting seem to have been satisfactory, and it now looks as though the unification of the management of all the German railroads might actually take place in the not very distant future. Saxony and even Bavaria appear to be willing to support such a plan. The principal difficulty still in the way of unification is said to be the very moderate fourth-class railroad carriages, which exist and are much valued in Prussia, but which do not exist and are somewhat unpopular in the southern states. This difficulty seems in a fair way to be solved.

A similar movement appears also to be on foot in the two Mecklenburg Duchies, where it is reported that a petition will be presented to the local diet for uniting the management of the Mecklenburg railroads with that of the Prussian system.—*Consular Report.*

A Curious Wreck.

The accompanying photograph shows a remarkable wreck which occurred recently in the middle west. The engine shown in the picture was engaged in pushing a string of four loaded coal cars up a steep grade when the drivers commenced to slip and it was impossible to regain control of the train. In the smash-up that followed, the four cars and the engine, descending the hill together with the engine on the down side going rear-end first, struck a string of passenger coaches, with the result shown in the picture. No one was injured.



It is up to the Derrick!

Disastrous Fire at New Orleans.

On the evening of Sunday last, the grain elevators and warehouses of the Illinois Central at New Orleans, known as the Stuyvesant Docks, extending along the river front for more than half a mile, were completely destroyed by a fire, which began in the conveyor of one of the elevators and which soon

got entirely beyond the control of the Fire Department. The loss is estimated at $2,500,000 on the buildings and an equal sum on merchandise, cars and other property. Fifty cottages in the neighborhood of the terminal were burned up. The elevators were partly filled with grain, and it is said that the amount of wheat destroyed was 600,000 bushels. The loss of cotton was 20,000 bales, and of sugar, 12,000 barrels. Sixty freight cars were burned up and ten ocean steamers were badly scorched. The grain dealers have made arrangements to do business at the Chalmette and Westwego elevators, so far as possible, and they claim that the export business of the port will not be badly disturbed. Officers of the railroad company say that the terminal buildings and facilities will be entirely restored within 18 months.

Exhibitors at International Railway Congress.

The following is a list of companies which have already taken space in the exhibition grounds of the American Railway Appliances Exhibition:

Acme White Lead & Color Works, Detroit, Mich.
Adams & Westlake Company, Chicago, Ill.
American Brake Co., St. Louis, Mo.
American Brake Shoe & Foundry Co., New York.
American Car & Foundry Co., New York.
American Hoist & Derrick Co., St. Paul, Minn.
American Lock Nut Co., Boston, Mass.
American Locomotive Co., New York.
American Railway Supply Co., New York.
American Steel Foundries, New York.
Anglo-American Varnish Co., Newark, N. J.
Armstrong Bros. Tool Co., Chicago, Ill.
Ashton Valve Co., Boston, Mass.
Automatic Air & Steam Coupler Co., St. Louis, Mo.
Baldwin Locomotive Works, Philadelphia, Pa.
Barbour-Stockwell Co., Cambridgeport, Mass.
Barney & Smith Car Co., Dayton, O.
Barnett Equipment Co., Newark, N. J.
Beaver Dam Malleable Iron Co., Beaver Dam, Wis.
Beckwith-Chandler Co., New York.
Benjamin Atha & Co., Newark, N. J.
Berry Bros., Ltd., Detroit, Mich.
C. H. Besley & Co., Chicago, Ill.
Bettendorf Axle Co., Davenport, Iowa.
L. J. Bordo Co., Philadelphia, Pa.
S. F. Bowser & Co., Fort Wayne, Ind.
Harold P. Brown, New York City.
Brown & Co., Inc., Pittsburg, Pa.
Brown Hoisting & Conveying Co., Cleveland, O.
Buckeye Steel Castings Co., Columbus, O.
Bucyrus Co., South Milwaukee, Wis.
Buda Foundry & Mfg. Co., Chicago, Ill.
Buffalo Forge Co., Buffalo, N. Y.
Cambria Steel Co., Philadelphia, Pa.
Camel Co., Chicago, Ill.
Philip Carey Mfg. Co., Cincinnati, O.
Carnegie Steel Co., Pittsburg, Pa.
Chenoweth & McNamee, Brooklyn, N. Y.
Chicago Car Heating Co., Chicago, Ill.
Chicago Pneumatic Tool Co., Chicago, Ill.
Chicago Railway Equipment Co., Chicago, Ill.
Cling Surface Co., Buffalo, N. Y.
W. H. Coe Mfg. Co., Providence, R. I.
Consolidated Car Heating Co., New York.
Consolidated Ry. Elec. Lighting & Equip. Co., New York.
Continuous Rail-Joint Co., Newark, N. J.
Curtain Supply Co., Chicago, Ill.
Damascus Brake-Beam Co., St. Louis, Mo.
John Davis Co., Chicago, Ill.
Paul Dickinson, Chicago, Ill.
Dilworth, Porter & Co., Ltd., Pittsburg, Pa.
Dressel Railway Lamp Works, New York.
Duff Mfg. Co., Pittsburg, Pa.
O. M. Edwards Co., Syracuse, N. Y.
Electro-Dynamic Co., Bayonne, N. J.
Elliott Frog & Switch Co., East St. Louis, Ill.
Empire Safety Tread Co., Brooklyn, N. Y.
Fairbanks, Morse, & Co., Chicago, Ill.
Falls Hollow Stay Bolt Co., Cuyahoga Falls, O.
Farlow Draft Gear Co., Baltimore, Md.
Flannery Bolt Co., Pittsburg, Pa.
Foster Engineering Co., Newark, N. J.
Frost Railway Supply Co., Detroit, Mich.
Galena-Signal Oil Co., Franklin, Pa.
General Electric Co., New York.
General Railway Signal Co., Buffalo, N. Y.
Gold Car Heating & Lighting Co., New York.
Wm. Goldie, Jr., & Co., Pittsburg, Pa.
Goldschmidt Thermit Co., New York.
Goodwin Car Co., New York.
Gould Coupler Co., New York.
Hale & Kilburn Mfg. Co., Philadelphia, Pa.
Hartford Rubber Works, Hartford, Conn.
Heywood Bros. & Wakefield Co., Wakefield, Mass.
Independent Railroad Supply Co., Chicago, Ill.
Ingersoll-Sergeant Drill Co., New York.
International Correspondence Schools (Railway Department), Chicago, Ill.
International Nickel Co., New York.
Jenkins Bros., New York.
H. W. Johns-Manville Co., New York.
Jones & Laughlin, Pittsburg, Pa.
Philip S. Justice & Co., Philadelphia, Pa.
Keith Mfg. Co., Sagamore, Mass.
Thos. Kendrick, Glenwood Springs, Colo.
Lackawanna Steel Co., New York.
Lawrence Switch Co., Duluth, Minn.
Lehigh Portland Cement Co., Allentown, Pa.
Gustav Lindenthal, New York.
Lodge & Shipley Machine Tool Co., Cincinnati, O.
Lowe Bros. Co., Dayton, O.
Jno. Lucas & Co., Philadelphia, Pa.
Lunkenheimer Co., Cincinnati, O.
Walter MacLeod & Co., Cincinnati, O.
Mahoney R. R. Ditching Machine Co., Vincennes, Ind.
A. Major, New York.
Manning, Maxwell & Moore, New York.
Jno. W. Masury & Son, Brooklyn, N. Y.
McConway & Torley Co., Pittsburg, Pa.
McCord & Co., Chicago, Ill.
Mechanical Rubber Co., Chicago, Ill.
Mechanical Rubber Works, Cleveland, O.
Merritt & Co., Philadelphia, Pa.
Moran Flexible Joint Co., Louisville, Ky.
Morden Frog & Crossing Works, Chicago, Ill.
Municipal Engineering & Contracting Co., Chicago, Ill.
Murphy Varnish Co., Newark, N. J.
Nathan Mfg. Co., New York.
National Lock Washer Co., Newark, N. J.
National Malleable Castings Co., Cleveland, O.
New York Air-Brake Co., New York.
New York Belting & Packing Co., New York.
Norfolk Creosoting Co., Norfolk, Va.
Oliver Machinery Co., Grand Rapids, Mich.
Pantasote Co., New York.
Peerless Rubber Mfg. Co., New York.
Pennsylvania Steel Co., Philadelphia, Pa.
Perry Side Bearing Co., Joliet, Ill.
Pettibone, Milliken & Co., Chicago, Ill.
Pittsburg Spring & Steel Co., Pittsburg, Pa.
H. K. Porter Co., Pittsburg, Pa.
Pratt & Letchworth Co., Buffalo, N. Y.
Pressed Steel Car Co., New York.
Pyle National Electric Head-Light Co., Chicago, Ill.
Railroad Gazette, New York.
Railroad Supply Co., Chicago, Ill.
Railway Age, Chicago, Ill.
Railway Appliances Co., Chicago, Ill.
Railway Equipment & Publication Co., New York.
Railway Master Mechanic, Chicago, Ill.
Ramapo Iron Works, Hillburn, N. Y.
Rand Drill Co., New York.
Rodger Ballast Car Co., Chicago, Ill.
St. Louis Car Co., St. Louis, Mo.
St. Louis Expanded Metal Fireproofing Co., St. Louis, Mo.
St. Louis Malleable Castings Co., St. Louis, Mo.
Safety Car Heating & Lighting Co., New York.
Schoen Steel Wheel Co., Philadelphia, Pa.
Sherwin-Williams Co., Cleveland, O.
Simplex Railway Appliance Co., Chicago, Ill.
Standard Coupler Co., New York.
Standard Paint Co., New York.
Standard Steel Car Co., New York.
Standard Steel Works, Philadelphia, Pa.
Star Brass Mfg. Co., Boston, Mass.
Storrs Mica Co., Owego, N. Y.
T. H. Symington Co., Baltimore, Md.
Trojan Car Coupler Co., New York.
Underwood Typewriter Co., New York.
Union Spring & Mfg. Co., Pittsburg, Pa.
Union Steel Casting Co., Pittsburg, Pa.
Union Switch & Signal Co., Pittsburg, Pa.
U. S. Metal & Mfg. Co., New York.
W. T. Van Dorn Co., Chicago, Ill.
Verona Tool Works, Pittsburg, Pa.
Victor Stoker Co., Cincinnati, O.
Weber Railway Joint Mfg. Co., New York.
West Disinfectant Co., New York.
Western Tube Co., Kewanee, Ill.
Western Wheeled Scraper Co., Aurora, Ill.
Westinghouse Air-Brake Co., Pittsburg, Pa.
Westinghouse Electric & Mfg. Co., Pittsburg, Pa.
Westinghouse Machine Co., Pittsburg, Pa.
Westinghouse Traction Brake Co., Pittsburg, Pa.
Wm. Wharton, Jr., & Co., Inc., Philadelphia, Pa.
Wheel Truing Brake Shoe Co., Detroit, Mich.
R. D. Wood & Co., Philadelphia, Pa.
Wyman & Cordon, Worcester, Mass.
Yale & Towne Mfg. Co., New York.

Manufacturing and Business.

The Mississippi Central is in the market for several miles of 60-lb. relaying rail.

The Youngstown (Ohio) Car Company's works, according to local reports, are to be enlarged.

The Independent Railroad Supply Co., Chicago, has been given an order for 25 miles of Wolhaupter rail joints by the Cincinnati, New Orleans & Texas Pacific.

The Farlow Draft Gear Company, Baltimore, Md., has moved from its temporary offices, which it has been using since the Baltimore fire of last February, into its new offices in the Continental Trust Building.

Mr. David O. Holbrook, who has resigned as Vice-President of the Pennsylvania Malleable Company and Central Car Wheel Company, is now Vice-President of the Dayton Pipe Coupling Company. His office will be at Pittsburg, Pa.

The Monarch Railway Supply Co., Detroit, Mich., state that in order that there may be no confusion or conflict with previously organized companies using the name "Monarch" it has changed the name of the above company to The Frost Railway Supply Co.

The Chicago Pneumatic Tool Co. has bought the Philadelphia Pneumatic Tool Co. and will make and sell the Keller tools. Mr. Julius Keller, formerly the President of the Philadelphia Pneumatic Tool Co., has been made a director in the Chicago company.

Robert P. Lamont has been appointed Manager of the American Steel Foundries. He will be in charge of works for the Chicago district, with headquarters at Indiana Harbor, Ind., and will succeed Mr. R. E. Janney, who resigned to become the manager of the coupler department.

The J. G. Brill Co., of Philadelphia, report orders for their 21-E truck from the Cape Government Tramways of Cape Colony; the Companhia Carris de Ferro do Porto, Porto, Portugal; The British Columbia Electric Railway Co., Vancouver, B. C., and the Ferro Carril Guaqui a La Paz, Bolivia.

Wm. M. Jewell, Chicago, previously with the New York Continental Jewell Filtration Co., announces that hereafter he will devote his entire time to chemical and consulting engineering, giving special attention to water supplies, filtration and softening plants, and as expert in patent cases. His office is 608-9 Cable Building, Chicago.

The Northern Engineering Works, Detroit, Mich., has been awarded a contract for the electric traveling cranes required in the new plant of the Detroit Steel Casting Co. There will be one 30-ton, 4-motor crane, and two 10-ton, 3-motor cranes, all 70 ft. span. The above company has also secured a contract for one 3-motor, 5-ton special electric traveling crane from the Michigan Malleable Iron Co.

Bids are wanted March 14 by the Bureau of Supplies and Accounts, Washington, D. C., for machine tools, etc., at the Portsmouth, New York, League Island and Norfolk navy yards, the Naval Academy, Annapolis, and the naval station, Guantanamo, Cuba, to include concrete mixer, hoisting engines, derricks, pile drivers, etc., rod machine, wood lathe, mortiser, ripsaw table, motor drive outfit for pipe threading machine, gap lathe, and rotary melting furnace outfit.

Robert Spencer has been appointed Eastern Sales Manager for the Buda Foundry & Manufacturing Co., Chicago, and will have full charge of the office in the Havemeyer Building, New York City. This company has recently greatly increased its facilities for handling eastern business, and in future will carry a full line of specialties in New York for the convenience of its patrons in that territory.

The United States Circuit Court for the Eastern District of Wisconsin on February 20 sustained the contention of the Westinghouse Electric & Manufacturing Company that the synchronous motors of the National Electric Company were an infringement of the rights covered in certain Tesla patents, and the National Company has been enjoined from the further sale of such motors. The decision in the suit is the first that has been obtained in the litigation begun sometime ago by the Westinghouse Company to prevent the sale of the synchronous motors and rotary converters by American manufacturers not enjoying a license under the Tesla polyphase motor patents.

Iron and Steel.

The Great Northern and the Northern Pacific have each contracted for about 25,000 tons of rails.

The Rock Island has given contracts for 49,000 tons of rails. It is said that the entire contract goes to the United States Steel Corporation.

The Lackawanna Steel Company has secured orders for about 10,000 tons of rails

from eastern lines, also for 25,000 tons for the Boston & Maine for April, May and June delivery, in addition to the 159,000 tons recently placed by western roads.

The Lackawanna Steel Company has decided to erect a billet mill and several other buildings at Buffalo, N. Y. President Clark has ordered expenditures of $1,000,000 for extensions.

The Cincinnati, Hamilton & Dayton has given a contract to the Lackawanna Steel Co., Buffalo, N. Y., for 10,000 tons of 85-lb. rails to be used for rebuilding the line from Indianapolis to Cincinnati.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies see advertising page 24.)

Canadian Society of Civil Engineers.

At a meeting of this society on February 25, a paper was read on "Port Colborne Harbor Work" by J. M. Hogan.

Railway Club of Pittsburg.

At the meeting of this club on February 24, a paper on "Freight Claims" was read by W. A. Terry, of the Pittsburg & Lake Erie.

Engineers' Club of St. Louis.

At the regular meeting of this club March 1, a paper on "Our Grade Crossing Problem" was presented by Mr. Carl Gayler.

Franklin Institute.

At a stated meeting of the Sections on March 2 the programme included a paper on "The Application of Highly Superheated Steam to Locomotives and the Probable Economy and Increase of Power to Be Derived Therefrom," by Prof. W. F. M. Goss; also one on "Foundry Molding Machines" by E. H. Mumford, of the Tabor Manufacturing Company, Philadelphia.

Purdue University.

On Feb. 24 Mr. Henry M. Towne, President of the Yale & Towne Manufacturing Company, and Past-President of the American Society of Mechanical Engineers, delivered an address before the faculty and students of Purdue on Industrial Engineering. The University announces that lectures are to be given by Gen. William Barclay Parsons and Mr. Frederic A. C. Perrine.

American Society of Mechanical Engineers.

Secretary F. R. Hutton announces that hereafter only 20 papers will be received by this society for any meeting. Those received after the first 20 will be held for the following meeting, and manuscript received later than 60 days prior to the opening day of any meeting will probably be held over in the same manner.

American Society of Civil Engineers.

At the regular business meeting of this Society March 1 a paper entitled "Technical Methods of River Improvement, as Developed on the Missouri River, by the General Government, from 1876 to 1903," by S. Waters Fox, M. Am. Soc. C. E., was presented for discussion. This paper was printed in the January number of "Proceedings."

PERSONAL.

—Mr. Willis W. Vail, who has resigned as Chief Engineer of the Gulf & Ship Island Railroad, is now Engineer for Hodges & Mimms, railroad contractors of Birmingham, Ala.

—Mr. William G. Macdowell, Vice-President of the Norfolk & Western, was born at Philadelphia, Pa. He began his railroad service in 1868 with the Empire Transportation Company. In 1873 he was appointed Auditor. In 1879 he went to the Shenandoah Valley, where he was Assistant Treasurer. This road was absorbed by the Norfolk & Western, and in 1881 Mr. Macdowell was appointed Treasurer of the N. & W., and he has been in charge of the Treasury of the road and its affiliated companies ever since.

—Mr. W. A. Whitney, whose promotion to be Superintendent of the Wyoming Division of the Union Pacific at Cheyenne was recently announced, is about 43 years old. Mr. Whitney's first position was in the Western Union telegraph office at Oakland, Cal. Later he was agent, operator and train despatcher for various railroad companies, including the Oregon Railroad & Navigation, the Southern Pacific, the Missouri Pacific, the Northern Pacific and the Oregon Short Line. In 1900 he was appointed Assistant Superintendent of the Wyoming Division of the Union Pacific at Laramie, but was later transferred to Cheyenne, which position he has held until now.

—Mr. Henry M. Sperry, Mem. Am. Soc. C. E., who has resigned his position with the Union Switch & Signal Company, has been appointed Consulting Signal Engineer of the

Hudson Companies, with office at 128 Broadway, New York City. "Hudson Companies," the name of the corporation in which are combined the Hudson River tunnel, which reaches the New York shore at Christopher street, Manhattan (of which one tube is already finished), and the "New York & Jersey Railroad," the tunnel to be built from the Pennsylvania Railroad terminus at Jersey City (Montgomery street), to Cortlandt street, Manhattan. The Consulting Signal Engineer, as well as the other members of the engineering department having to do with tracks and operation, are now engaged in the preliminary work. Mr. Sperry has had much experience in general railroad engineering, having been engaged in solving operating questions, preliminary to the establishment of new lines, on the Pennsylvania, the Chicago Elevated, and the Union depot at St. Paul. He prepared the preliminary plans for the signaling in the New York Subway. Mr. Sperry was born in 1861 and entered railroad service in 1881 on the Pennsylvania. He was on that road for ten years and was Supervisor of Signals on the New York division for seven years of that time. While he was there the greater part of this division was changed from a two-track to a four-track line. The interlocking at the Jersey City terminal, built about 1890, is one of the few plants of that kind that it has not been found necessary to alter. In 1891 Mr. Sperry resigned and went to the Johnson Railroad Signal Company; and with this and its successor, the National Company, he remained eight years, and during the latter part of this time was General Agent at Chicago, where he designed and built the large mechanical interlocking at State Line, Ind. In 1899 the absorption of the National Company by the Union Switch & Signal Company took Mr. Sperry back to New York, where he has been for the last six years.

—Mr. Joseph B. Lacy, who succeeds Mr. Macdowell as Treasurer of the Norfolk & Western, was born at Lynchburg, Va. He entered the service of the Norfolk & Western in the paymaster's department in 1882. In 1887 he was appointed Acting Paymaster, and in 1888 he was appointed Paymaster of the company. He continued as Paymaster through the reorganization of the company, and on Jan. 1, 1903, was appointed Assistant Treasurer, which office he has since held.

ELECTIONS AND APPOINTMENTS.

Baltimore & Ohio.—Harry R. Talcott, hitherto Assistant Engineer at Cumberland, has been appointed Engineer of Surveys, with headquarters at Baltimore, Md., succeeding F. L. Stuart, resigned.

Chicago & Eastern Illinois.—H. I. Miller, General Manager of the Chicago, Rock Island & Pacific, has been appointed Second Vice-President and General Manager of the C. & E. I.

Chicago & North Western.—R. C. Satley has been appointed Division Engineer, with headquarters at Winona, Minn., succeeding W. Beahan, resigned.

Chicago, Burlington & Quincy.—W. B. Hamblin, hitherto Assistant General Freight Agent of the Lines East of the Missouri River, has been appointed General Freight Agent; office at Chicago.

Chicago, Rock Island & Pacific.—J. F. Stevens, Second Vice-President, will until further notice discharge the duties of General Manager. The jurisdiction of Guy Adams, Supervisor of Mails at Chicago, has been extended over the Chicago, Rock Island & Gulf.

Cleveland, Akron & Columbus.—J. F. Miller, Vice-President, has been retired on a pension under the company's age-limit rule. He has completed over 50 years' service and is 75 years old.

Connecticut R. R. Commission.—Governor Roberts announces the nomination of Andrew F. Gates, of Hartford, to be Railroad Commissioner.

Cornwall & Lebanon.—G. F. McKay has been appointed Traffic Manager.

Denver & Rio Grande.—A. C. Ridgway, hitherto General Manager of the Denver, Northwestern & Pacific, has been appointed General Manager of the D. & R. G., effective March 1.

Denver, Northwestern & Pacific.—W. F. Jones, hitherto Auditor, has been appointed General Manager, succeeding A. C. Ridgway, resigned. (See Denver & Rio Grande.)

Illinois Central.—C. F. Krebs, hitherto Assistant Comptroller, has been appointed Comptroller.

Iowa Central.—C. P. Eastman has been appointed Assistant General Freight Agent, with office at Minneapolis, Minn. Mr. Eastman holds the same position on the Minneapolis & St. Louis.

Louisville & Nashville.—W. L. Mapother, hitherto Assistant to the President, has been elected First Vice-President.

Midland Valley.—F. A. Moliter has been appointed Chief Engineer, with office in St. Louis, Mo. J. F. Elder has been appointed General Manager, in charge of traffic. The office of Chief Engineer and General Man-

ager, and that of Traffic Manager, have been abolished, effective March 1.

Minneapolis & St. Louis.—H. F. Marsh has been appointed Assistant General Freight Agent, with office at Minneapolis. Mr. Marsh holds the same position on the Iowa Central. S. G. Lutz has been appointed Assistant General Freight Agent, with office at Peoria, Ill. Mr. Lutz holds the same position on the Iowa Central.

Missouri Pacific.—J. W. Higgins, hitherto Inspector of Transportation, has been appointed Assistant General Manager in charge of transportation of this company and the St. Louis, Iron Mountain & Southern, with office at St. Louis; effective March 1.

New York, New Haven & Hartford.—J. H. Sanford has been appointed Assistant Purchasing Agent, with headquarters at New Haven, Conn.

Northern Central.—The jurisdiction of the following officers of the Pennsylvania has been extended over the N. C., M. Riebenack, Comptroller; R. H. Large, Coal Freight Agent, and L. H. Barker, Assistant Chief Engineer.

Norfolk & Western.—William G. Macdowell has been appointed Vice-President, in charge of Financial and Accounting Departments, with office at Philadelphia. E. H. Alden has been appointed Secretary and Assistant Treasurer, succeeding A. J. Hemphill, resigned. Joseph B. Lacy has been appointed Treasurer, with office at Roanoke, Va., succeeding Mr. Macdowell, and H. W. Griffith succeeds Mr. Macdowell as Assistant Secretary, effective March 1.

Pennsylvania.—The following changes in the auditing department of this company were recently announced: E. A. Stockton, Assistant Auditor of Disbursements, promoted to Assistant to the Comptroller; Samuel Anderson, Assistant Auditor of Passenger Receipts, promoted to Auditor of Miscellaneous Receipts and Accounts; J. S. Donaldson, Chief Clerk to the Comptroller, promoted to Assistant Auditor of Miscellaneous Receipts and Accounts; George B. Rudduck, Special Agent in Comptroller's Department, promoted to Assistant Auditor of Disbursements; J. F. Reynolds, Assistant Auditor of the Empire Line, promoted to Auditor; M. Homer, Assistant Superintendent, Voluntary Relief Department, promoted to Assistant Auditor of Passenger Receipts; Edon B. Hunt, clerk, promoted to Assistant Superintendent of Voluntary Relief Department. The title of Auditor of Freight Receipts was changed to Auditor of Merchandise Freight Receipts. Jefferson Justice, the present incumbent, was named for the new place. H. C. McKeever, Assistant Auditor of Freight Receipts, was made Assistant Auditor of Merchandise Freight Receipts. All changes are effective on March 1.

St. Louis, Iron Mountain & Southern.—O. M. Sewell has been appointed Superintendent of the White River Division, with headquarters at Aurora, Mo., succeeding R. P. Dalton, resigned. See Missouri Pacific.

Savannah & Statesboro.—J. R. Anderson has been elected President, succeeding Cecil Gabbitt.

Southern.—R. J. Curran has been appointed Assistant General Freight Agent of the Louisville Division, with headquarters at Louisville, Ky., succeeding E. Fitzgerald, deceased. R. A. Campbell has been appointed Manager of the Asheville Line, with headquarters at St. Louis, Mo., succeeding Mr. Fitzgerald.

J. C. Burrows, Superintendent of Dining Car Service, has resigned.

LOCOMOTIVE BUILDING.

The Illinois Tunnel Co. is reported to have ordered 75 electric locomotives.

The Australian Government has ordered 20 locomotives from the Baldwin Works.

The Chicago, Rock Island & Pacific has ordered eight locomotives from the Schenectady Works of the American Locomotive Co.

The Chicago, Lake Shore & Eastern has ordered six simple consolidation (2-8-0) locomotives from the American Locomotive Co., with cylinders 22 in. x 28 in. and 51-in. drivers.

The New York Central & Hudson River has ordered 25 class G consolidation locomotives from the Schenectady Works of the American Locomotive Co.

The Grand Central Station and Harlem Line has ordered five six-wheel switching (0-6-0) locomotives from the Schenectady Works of the American Locomotive Co. for use at the Grand Central Station, New York.

The Portland & Rumford Falls has ordered one six-wheel (0-6-0) switching locomotive from the Manchester Works of the American Locomotive Co. This locomotive will weigh 132,000 lbs.; cylinders, 20 in. x 26 in.; diameter of drivers, 50 in.; sloping tender, with a tank capacity of 3,500 gallons of water.

The Buffalo, Rochester & Pittsburg, as reported in our issue of February 24, has ordered 20 simple consolidation (2-8-0) locomotives from the American Locomotive Co. for July, August and September delivery. These locomotives will weigh 186,000 lbs., with 166,000 lbs. on drivers; cylinders 21 in. x 28 in.; diameter of drivers, 57 in.; radial stayed extended wagon-top boiler, with a working steam pressure of 210 lbs.; heating surface, 2,862 sq. ft.; 354 tubes, 2 in. in diameter and 14 ft. 6⅜ in. long; Lukens steel firebox, 108 in. x 74 in.; grate area, 54 sq. ft.; tank capacity, 6,000 gallons, and coal capacity, 12 tons. The special equipment will include: Westinghouse air-brakes, Hammet bell ringers, Keasby & Mattison sectional magnesia boiler lagging, Pennsylvania special reinforced brake beams, Climax couplers, Dressel headlights, Hancock injectors, United States piston and valve rod packings, Consolidated safety valves, Leach sanding devices, Nathan bull's-eye sight-feed lubricators, Railway Steel Spring Co.'s springs, and Ashcroft steam gages.

CAR BUILDING.

The Illinois Tunnel Co. is reported to have ordered 3,000 freight cars.

The American Car & Foundry Company reports miscellaneous orders for 200 cars.

The Brooklyn Rapid Transit has ordered 100 cars for elevated service for July delivery.

The Ingoldsby Automatic Car Co., of St. Louis, has ordered 100 dump cars from the Pullman Co.

The Chattanooga Southern has ordered 60 gondolas from the American Equipment Co., of Atlanta, Ga.

The Mobile, Jackson & Kansas City has ordered 500 box cars from the American Car & Foundry Co.

The Detroit & Toledo Shore Line has ordered 100 gondola cars from the American Car & Foundry Co.

The St. Louis Chemical Co., St. Louis, Mich., has ordered 12 tank cars from the Bettendorf Axle Co.

The Norfolk & Western is reported to have ordered six passenger and baggage cars from the American Car & Foundry Co.

The Erie is reported to have bought the three Pullman drawing-room cars on exhibition at the World's Fair in St. Louis.

The Berwind-White Coal Mining Company, of Windber, Pa., is reported to have ordered 30 coal cars from the Cambria Steel Co.

The Maryland & Pennsylvania is reported to have ordered 10 freight cars from the South Baltimore Steel Car & Foundry Co.

The Delaware, Lackawanna & Western has ordered 19 passenger cars from Barney & Smith and 10 from the American Car & Foundry Co.

The Atchison, Topeka & Santa Fe has ordered through the Rodger Ballast Car Co. 350 ballast cars from the American Car & Foundry Co.

The Coal & Coke R. R. is reported to have ordered 200 steel gondola cars of 80,000 lbs. capacity from the South Baltimore Steel Car & Foundry Co.

The Pennsylvania, it is reported, has ordered 2,500 gondola cars from the Pressed Steel Car Co. and 500 box cars from the Cambria Steel Co., for August delivery.

The Philadelphia & Easton (Electric) has ordered four motor passenger cars and two motor combination passenger and baggage cars from the American Car & Foundry Co.

The Delaware, Lackawanna & Western, in addition to orders reported in previous issues, has ordered 15 first-class passenger cars, one dining car, three combination baggage and smoking cars, and one combination baggage, smoking and buffet car for 1905 delivery.

The Cincinnati, Hamilton & Dayton and Pere Marquette System is reported to have ordered 150 steel underframe gondolas and 25 cabooses for the Pere Marquette, and 25 cabooses, a steel wrecking crane, and a steel pile driver for the Cincinnati, Hamilton & Dayton.

The Chicago, Lake Shore & Eastern has ordered 1,000 side dump steel cars of 100,000 lbs. capacity from the American Car & Foundry Co. The special equipment will include: Simplex bolsters and springs, Westinghouse air-brakes, Tower and Major couplers, McCord journal boxes, and Barber trucks.

The Vandalia Line has ordered 300 steel-underframe box cars of 100,000 lbs. capacity from the American Car & Foundry Co. The special equipment is to include: Pennsylvania Railroad specification axles, brasses, springs and paint; National-Hollow brake-beams and Westinghouse air-brakes and draft rigging.

The J. G. Brill Company, of Philadelphia, Pa., as reported in our issue of February 24, has received orders for 13-ft. 8-in. open horse cars, 14-ft. closed horse cars, and 22-ft. flat passenger cars mounted on freight car trucks from the Zanzibar Railroad Co.; also for the J. G. Brill Co.'s patented semi-convertible cars mounted on their 21-E truck, from the Cape Government Tramways, of Cape Colony.

The Seaboard Air Line has ordered 250 steel flat bottom gondola cars of 80,000 lbs. capacity from the Pressed Steel Car Co. These cars will be 39 ft. 4 in. long over end sills, 9 ft. ½ in. wide over side sills, and 8 ft. ¼ in. high from rail to top of side. The special equipment will include: Westinghouse air-brakes, Tower couplers, Seaboard Air Line twin-spring rigging, Symington journal boxes and arch-bar Diamond trucks.

The Boston & Maine has ordered some box cars of 60,000 lbs. capacity of American Railway Association standard, some hopper bottom 31-ft. coal cars of 60,000 lbs. capacity, and some Pratt's patent 32-ft. coal cars of 60,000 lbs. capacity from the Laconia Car Co. All cars will weigh from 28,000 lbs. to 30,000 lbs., and measure 8 ft. wide, and the coal cars will be 4 ft. high. The exact number of cars has not yet been determined upon. The special equipment for all will include: Pressed Steel bolsters and trucks. Westinghouse air-brakes, Ford & Kimball and Hardy brasses, Gould couplers, Miner draft rigging and Ford & Kimball and Laconia Car Co.'s wheels.

The Chicago & North Western has ordered 18 coaches, four parlor cars and three chair cars from the Pullman Co. for March, April and May delivery. The coaches will be 63 ft. 6½ in. long, 10 ft. ¼ in. wide, and 14 ft. 2½ in. high. The parlor cars will be 74 ft. 3 in. long, 10 ft. ¼ in. wide, and 14 ft. 2¾ in. high. The chair cars will be 78 ft. long, 10 ft. ¼ in. wide, and 14 ft. 2¾ in. high. The special equipment for all will include: Na-

tional-Hollow brake-beams, Christie brake-shoes, Westinghouse air-brakes, Chicago couplers, Pintsch gas, Chicago & North Western standard paint, Standard Steel Co.'s platforms, Railway Steel Spring Co.'s springs, Pullman standard trucks, and National wheels.

The Mobile & Ohio, as reported in our issue of February 17, has ordered seven baggage and mail cars from the American Car & Foundry Co. These cars are to measure 70 ft. long, 9 ft. 8 in. wide and 9 ft. 3⅝ in. high, floor to ceiling, with wooden frames and underframes. The special equipment includes: Open-hearth steel axles, Commonwealth double cast-steel bolsters, National-Hollow brake-beams, American Brake Shoe Co.'s Streeter brake-shoes, Westinghouse air-brakes, Hodge air-brake levers, lead-lined brasses, Tower couplers, American Car & Foundry Co.'s draft gear, Harrison dust guards, Spear stoves, Safety Car Heating & Lighting Co.'s steam heating system, Pintsch light, Love Bros.' paint, Pullman dummy vestibules, canvas-covered roofs with copper flashing, Railway Steel Spring Co.'s springs, American Car & Foundry Co.'s six-wheel trucks, Paige 36-in. wheels, Latrobe tires and Miner gravity side bearings. The mail apartment is to be 35 ft. long and will be arranged in accordance with the plans and specifications of the United States Railway Mail Service.

BRIDGE BUILDING.

Boyce, La.—Both Houses of Congress have passed the bill authorizing a bridge over the Red river, at or near Boyce, La.

Buffalo, N. Y.—The lowest of the bids recently opened for building the substructure of the bascule bridge on Ohio street over the Buffalo Canal was that of Bardol & Roberts, at $59,260.

Clifton, Ariz.—The new steel bridge of the Arizona & New Mexico over the San Francisco river has been carried away by heavy floods.

Dayton, Ohio.—The City Council, at a recent meeting, passed an ordinance to issue $120,000 in bonds, the proceeds to be used for building the new Washington street bridge over the Great Miami river.

Idaho.—The bill authorizing the Spokane International Ry. Co. to build bridges over Pend d'Oreille and Kootenai rivers, in Kootenai County, Idaho, has been passed by both Houses of Congress and signed by the President. (Feb. 10, p. 46.)

Indiana.—The bill introduced in both Houses of Congress authorizing the Vincennes, West Baden & Louisville Traction Co. to build a railroad bridge over White river, between Harrison Township, Knox County, and Washington Township, Pike County, Ind., was passed February 20 by the Senate. The plans to be approved by the Chief of Engineers and the Secretary of War.

Kansas City, Mo.—The pile bridges of the Kansas City Belt Line and the Rock Island have been destroyed by floating ice in the Kaw river, and may be replaced by steel structures.

Lexington, Mo.—A bill passed both Houses of Congress extending the time for beginning construction of the bridge over the Missouri river at Lexington, Mo., approved April 28, 1904, and extending its provisions to street railways.

Louisiana.—Both Houses of Congress have passed the bill authorizing the Alexander, Bayou Macon & Greenville Ry. Co. to build bridges over Red river, Little river and Bayou St. Louis, in Louisiana.

Milwaukee, Wis.—Plans are being made by Charles J. Poetsch, City Engineer, for building a viaduct at Sixth street to cost about $530,000.

Mt. Vernon, Ind.—Bids are wanted March 6 by the commissioners of Posey County for building five steel bridges. Silas G. Howard is County Auditor.

New York, N. Y.—The contract recently given by the New York, New Haven & Hartford to the New York Contracting & Trucking Co. for improvements on the roadway in the vicinity of New York includes the building of a large drawbridge over Pelham Bay.

Nolan, W. Va.—The Lower House of Congress has passed a bill authorizing the Borderland Coal Co. to build a bridge over Tug Fork of the Big Sandy river, about two miles east of Nolan, at the boundary line between West Virginia and Kentucky.

Ottawa, Ont.—The Canadian House of Commons has granted an extension of seven years to build the proposed bridge of the Canada Southern over the Detroit river, and five years for the bridges to connect with Grand Island below Niagara Falls. The time was also extended for five years for the building of the Canada & Michigan Bridge & Tunnel Co.'s bridge over the Detroit river.

Richland Center, Ark.—Bids are wanted May 1, by George Wufing, for building a steel bridge over the Wisconsin river at Tone Rock.

Roanoke, Va.—The Virginia Bridge & Iron Co., of this place, has been given a contract by the Deepwater Railway to build about 22 bridges on the line of its road.

St. Louis, Mo.—A contract has been given by the St. Louis Southwestern to the Missouri Valley Bridge Co. for building the piers of the new bridge to be built over the Red river a mile below this city. Bids will soon be asked for the superstructure.

Santa Fe, N. Mex.—Bids may soon be asked by the Chairman of the Board of County Commissioners, for building a three-arch stone bridge over the Santa Fe river. J. L. Zimmerman is County and City Engineer.

South Carolina.—On Feb. 24 the Lower House of Congress passed a bill authorizing bridges over the Ashley river, in Charles and Dorchester Counties, S. C.

Sunbury, Pa.—The County Commissioners have given the contract to build the steel highway bridge over the Susquehanna River at this point to the York (Pa.) Bridge Co. for $65,125.

Swainsboro, Ga.—Recent floods have carried away several bridges over the Ohoopee river in Emanuel and Tattnall counties; loss, about $200,000.

Topeka, Kan.—The Union Pacific has given a contract to William Neville at $50,000 for building a bridge on the new line of its road to be built between this place and Marysville.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

American-Mexican Pacific.—An officer writes that this company has been incorporated with headquarters at Tucson, Ariz., to build 2,000 miles of railroad. The first building will be from Phœnix, Ariz., southeast to Tucson, Calabasas and Naco, with a branch from Tucson to Dudleyville, at the junction of the Gila and San Pedro rivers, and a branch from Naco to San Jorge Bay, on the gulf of Cola, 250 miles of which is under contract to William C. Bradbury & Co., of Denver, Colo. Grading has already been begun. The completion of these sections of the line will bring it to the Pacific coast and to connections with the Southern Pacific, the El Paso & Southwestern, and the Atchison, Topeka & Santa Fe. Lyman Bridges is President and Chief Engineer; S. W. Purcell, General Attorney; D. M. M. Shorb, Purchasing Agent, and P. B. Ziegler, Master Mechanic.

Atchison Belt Line.—A company has been incorporated to build a belt line at Atchison, Kan. The incorporators include: H. E. Farrell, Freight Traffic Manager of the St. Louis Southwestern at St. Louis; William Carlisle and J. W. Allen, of Atchison.

Canadian Railway Finance Company.—This company has acquired a royal charter in London, England, with a temporary capital of $16,000, to build a railroad from Hudson Bay to the Pacific Ocean.

Chicago Southern.—This company, incorporated in September in Illinois to build from Terre Haute, Ind., north to Chicago, 170 miles, is reported to have let a contract to the People's Construction Co., of Davenport, Iowa, for concrete work, bridges and abutments on 27 miles of line.

Cincinnati, Georgetown & Portsmouth.—This company is reported to have let a contract to Thomas Denton, of West Union, Ohio, for building an extension of the road from Georgetown east to Eckmansville, 12 miles.

Corning, Keuka Lake & Ontario.—An officer writes that this road, which is projected to run eventually from Corning, N. Y., northward to Sodus Bay, on Lake Ontario, will at present be built from Savonia, on the Erie, northward through Sonora, Bradford and Wayne to Penn Yan, on the New York Central. Contracts will be let soon. R. H. Curtis, Bradford, N. Y., is President. (January 27, p. 31.)

Delaware & Hudson.—The contract for building the branch from Thurman, N. Y., to Warrensburg, 3.39 miles, has been let to P. Hart & Sons, of New Brighton, Staten Island, New York.

Denver, Enid & Gulf.—This company has put in operation an extension from Enid, Okla. T., northwest to Coldwater, 20 miles.

Des Moines & Eldora (Electric).—Surveys are under way for a proposed electric line under this name from Des Moines, Iowa, northwest to Eldora, 65 miles. Part of this survey was made some time ago by the Des Moines City Railway, over whose line the new company will enter the city of Des Moines. Judge Porter, of Eldora, is interested.

Duluth, St. Cloud, Glencoe & Mankato.—An officer writes that a contract has been let by this company to E. L. Tobie & Co., of New York and of Albert Lea, Minn., who have given a bond for $50,000 for its fulfillment, for building this road from Albert Lea north to Mankato, 52½ miles. A supplementary contract provides that locating surveys are to begin in March and grading on or before May 1. A. H. Reed, of Glencoe, Minn., is President, and W. W. Olney, Chief Engineer.

Fallon Railroad.—Surveys are reported to have been made for this proposed road from Leetville, Nev., to Fallon, 15 miles. R. L. Douglass, of Fallon, is President, and W. Fuller, Chief Engineer.

Greenback Railroad.—This company has been granted a charter by the Secretary of State of Tennessee to build a railroad from Greenback, Loudon County, to a connection with the Atlanta, Knoxville & Northern. The incorporators are: J. H. Ellis, J. H. Ringgold, J. H. Frantz, J. G. Johnson and J. B. Wright.

Grand Trunk.—The contract for double tracking the last section of single track between Montreal and Chicago is reported to have been let to Ross & McRae, of Montreal, to be finished August 1. The contract covers the building of a second track between London and Kingscourt Junction, 37.42 miles.

Gurdon & Fort Smith (Missouri Pacific).—An officer writes that this company, which proposes to build a line from Antoine, Ark., northwest to Greenwood, 100 miles, has let a contract for the first five miles of the line to the Dalhoff Construction Co. Four miles of this contract have been graded and track is laid for three miles. H. Rohwer, St. Louis, is Consulting Engineer.

Hidalgo & Northeastern.—Surveys for a proposed extension of this road to the port of Tuxpan, on the Gulf of Mexico, about 150 miles, are in progress. The road is now completed and in operation from the City of Mexico to Venta Colorado, 125 miles. Antonio Caso is Chief Engineer.

Hornellsville, Bath & Lake Keuka

(ELECTRIC).—This company has been incorporated at Albany, N. Y., with a capital of $50,000 to build an electric street railroad between the points named in the title. L. D. Masson and J. S. Hubbs, of Hammondsport, N. Y., and F. W. Hastings, of Bath, N. Y., are incorporators.

INDIANA HARBOR.—An officer writes that this company has let the contract for building its line from Indiana Harbor via Hartsdale, Morocco and Kentland, Ind., across the Illinois state line near Thomas to Danville, Ill., to the Knickerbocker Ice Co. There will be but three curves on the entire line, two of ½ deg. and one of 1 deg., with a maximum grade of 12½ ft. to the mile. C. W. Hotchkiss, Chicago, is President, and R. B. Seymour, Chief Engineer.

KANAWHA & POCOHONTAS.—This West Virginia company has completed its line from Paint Creek Junction to Mahan, 15 miles. Construction is under way from Mahan to Mossy Creek. C. M. Pratt, of Pratt, W. Va., is President.

KANSAS CITY, MEXICO & ORIENT.—An officer writes that this road, which is to run from Kansas City, Mo., via Wichita, Fairview, Sweetwater, Presideo, Chihuahua, Minaca and El Fuerte to Topolobampo, State of Sinaloa, Mexico, 1,630 miles, has its line from Kansas City southwest to Lone Wolf, 436 miles, under contract to the Union Construction Co., of Kansas City, and from Lone Wolf to Topolobampo, 1,194 miles, under contract to the International Construction Co., of Kansas City. The line is already in operation from Wichita, Kan., to Fairview, Okla. T., 130 miles, and in Mexico from Topolobampo northeast to El Fuerte, 62 miles; and the Chihuahua & Pacific, which is to be a part of the system, is in operation from a point west of Chihuahua to Minaca, 125 miles. Grading is completed for 30 miles north of Wichita and 100 miles south of Fairview; from Diaz, Tex., to Sweetwater, 130 miles, and 25 miles south of Sweetwater. Track is laid for 10 miles north of Sweetwater. On the Mexican division, grading is completed for 75 miles east of Chihuahua, for 40 miles southwest of Minaca and for 75 miles northeast of Topolobampo; and track is laid for 35 miles east of Chihuahua and for six miles southwest of Minaca.

The contract for building the Kansas City, Outer Belt & Electric has been let to L. J. Smith, of Kansas City. This will require about seven miles of double-track line to be laid with 80-lb. rails, reinforced steel concrete culverts and abutments, and plate girder bridges. (February 10, p. 47.)

KITTANNING RUN.—This company has been granted a charter in Pennsylvania to build a line from Altoona to Amsbry, Cambria County, 10 miles. The capital is $100,000, and among the incorporators are C. A. Buch, of Philadelphia, and John Lloyd, Charles C. Renshaw and Walter N. Wood, of Altoona.

LA DICHA & PACIFIC.—This company, which was incorporated last year in the City of Mexico with a capital of $2,000,000 and principal office at La Dicha, State of Guerrero, has surveyed its proposed line, which is to be built in the interests of the Mitchell Mining Co., of La Dicha and New York. The road is to run from the company's copper properties at La Dicha west to Port San Marquez, 12 miles south of Acapulco, on the Pacific coast of the State of Guerrero. The road will be narrow gage and have maximum grades of 4½ per cent. Several miles are reported to have been already graded. On the completion of the line the company plans to erect a 1,000-ton smelting plant at Port San Marquez. It is said that the Mexican Central will extend its Cuernavaca line south from the Balsas river to Chilpancingo, to which place it is the intention of the La Dicha & Pacific Company eventually to extend its line, thereby making a new through line from the City of Mexico to the Pacific coast at Port San Marquez. George Mitchell, of the Mitchell Mining Co., is one of the directors, and R. E. Morrison, of the City of Mexico, is Vice-President and General Counsel.

LECKRONE & LITTLE WHITELEY CREEK.—Surveys are reported under way for this proposed road from the mouth of Little Whiteley Creek, Green County, Pa., to Waynesburg, 15 miles. The road will connect at Waynesburg with the Waynesburg & Washington, which runs from Waynesburg to Washington.

MEMPHIS, INDIANOLA & GULF.—It is reported that the stockholders have authorized the beginning of construction work on this road and that contracts are to be let at once for building from Indianola, Miss., to Dockery, 25 miles. Preliminary surveys have been made for the entire line, which is projected from Memphis, Tenn., via Indianola, Dockery, Yazoo City and Jackson, Miss., to Gulfport, 450 miles. W. E. Ringold, Lyon, Miss., is President, and R. Craig, Heathman, Miss., Chief Engineer.

MEXICAN ROADS.—The Mexican Government has granted a concession for a railroad from Alamos, State of Sonora, northwest to the port of Guaymas, 150 miles.

Surveys are in progress for a railroad, 20 miles long, to connect the asphalt deposits near San Felipe, 100 miles southwest of Tampico, with Cucuilles, on the Toncochin river, which connects with the Tamiahua lagoon. P. W. Henry, representing the Pan-American Asphalt Co., of New York, is in charge.

The State of Chihuahua has granted a concession for a railroad from San Isador to Cerro de la Calera, in the Guerrere mining district of that state.

A railroad is projected from Santiago Papasquiaro, in the State of Durango, on the Tepehaunes branch of the Mexican International, to the San Andres mining district. The San Andres Mining Co. is interested.

The San Francisco del Oro Mines, Ltd., with headquarters at 65 London Wall, London, England, is planning to build a railroad from its mines, situated in the Parral district of Mexico, to a connection with either the Mexican Central or the Parral & Durango. James E. Hyslop is General Manager.

The Mexican Government has granted a concession to the Calera Mining Co. to build a road from its mines to a connection with some railroad. Surveys have been made and approved.

MIDLAND VALLEY.—An officer writes that this company, whose road is now in operation from Greenwood and Hartford, Ark., northwest to Tulsa, Ind. T., 160 miles, has let the contract for an extension of its line from Tulsa northwest via Skiatook to Pawhuska, Okla. T., 50 miles, to Kahman & McMurray, of Kansas City. The section from Tulsa to Skiatook, 15 miles, is practically completed, and from Skiatook to Pawhuska the road is now under construction.

MICHIGAN ROADS.—The Cleveland Cliffs Iron Co., of Marquette, which has made large purchases of timber lands from Hall & Munson, of Bay Mills, will, it is reported, build a railroad between Munising and Bay Mills, 100 miles, through timber and agricultural lands. Both of the last-named places are on the Duluth, South Shore & Atlantic.

MISSOURI CENTRAL (ELECTRIC).—This company, which is incorporated under the laws of Missouri with a capitalization of $12,000,000, plans to build an electric line from St. Louis west to Kansas City, 300 miles, for which a large portion of the rights of way are reported to have been secured. The company is interested in two bills now before Congress to authorize the construction of bridges across the Missouri river at St. Charles and at Glasgow, Mo. W. H. Chase, of Toledo, Ohio, and Fulton, Mo., is President of the company.

MINNESOTA & INTERNATIONAL (NORTHERN PACIFIC).—This company, whose road runs from Brainerd, Minn., north via Bemidji to Northome, 132 miles, is reported to have let to A. Guthrie & Co., of St. Paul, a contract for building a 30-mile extension north from Northome.

MORRIS TERMINAL.—This company has been incorporated with a capital stock of $50,000 and headquarters at Chicago to build a belt railroad in the city of Morris, Ill. Charles E. Hook, Oscar Haeberle, C. P. Gardner and George T. Buckingham are incorporators.

NEW PARK & FAWN GROVE.—This company has been organized in Pennsylvania to build an extension of the Stewartstown Railroad from Stewartstown to Fawn, nine miles. The capital is to be $90,000. John H. Anderson is President, and John C. Wiley, Treasurer, both of York, Pa.

NORTHERN PACIFIC.—An officer gives status of construction work of this company as follows: Change of grade between Thornton, Idaho, and Kootenai, 16 miles, for which A. Guthrie & Co., of St. Paul, Minn., have the contract, is very nearly completed. (See Construction Supplement.)

The line from Hamptulips River, Wash., to the Quinault Indian Reservation, 14 miles, is completed, except for the ballasting and finishing of the upper end of the line. (See Construction Supplement.)

The second track between Auburn and Black River Junction, Wash., 15 miles, is completed. (See Construction Supplement.)

OCILLA & VALDOSTA.—An officer writes that this line, which is projected to run from Valdosta, Ga., via Nashville, Alapoha, Ocilla and Broxton to Helena, 90 miles, has the first section from Ocilla to Broxton under contract to Robert Talmadge. Track is already laid from Ocilla to Osierfield, 10 miles. The line has been surveyed from Broxton to Hazelhurst, 35 miles, and work on this section will shortly be begun. The Ocilla & Valdosta has no connection with the Ocilla, Pinebloom & Vandosta. J. J. Walker, of Ocilla, is Attorney for the company.

PENNSYLVANIA.—This company is reported to have awarded to the McClintic-Marshall Construction Co., of Pottstown, Pa., the contract for building the double-track elevated freight line 3,700 ft. long along Duquesne Way, Pittsburg.

QUEBEC & LAKE ST. JOHN.—An officer writes that the building of the La Tuque branch of this road from La Tuque Junction, 82 miles from Quebec, to La Tuque Falls, on the St. Maurice river, 40 miles, is under contract to Joseph Paquet, of Levis, Que. One mile of track is laid. (August 26, p. 74.)

RALEIGH & PAMLICO SOUND.—An officer writes that this company, whose projected line will run from Raleigh, N. C., via Wilson, Snow Hill and Greenville to Washington, N. C., 114 miles, has construction work under way by its own forces from Raleigh to Middlesex, 28 miles. Grading is completed for 12 miles and track laying for 6½ miles of this distance. (See Construction Supplement.)

RICHMOND, RAPPAHANNOCK & EASTERN.—This company has been incorporated in Virginia to build a railroad from Richmond to Urbanna, 59 miles. Surveys are reported to have been made and the company is now making financial arrangements.

ST. LOUIS SOUTHWESTERN.—This company, which owns the Texas & Louisiana, is reported to be making surveys from the terminus of the latter road at Monterey, Angelina County, Texas, via Windom, through San Augustine, Jasper, and Newton counties, to Newton, 50 miles.

SOUTHERN.—This company's branch from Okolona, Miss., to Houston, 29 miles, was completed during the latter part of 1904. (See Construction Supplement.)

The Big Mountain spur, three miles long, from Oliver Springs through Morgan County, has also been completed. (See Construction Supplement.)

The Badham spur from Dailey, Ala., along Savage creek, four miles, was completed during the latter part of 1904. (See Construction Supplement.)

The company is improving the roadbed and laying new rails on the Memphis division, between Stevenson, Ala., and Memphis.

The contract for building a branch from Mobile Junction to a point west of Bessemer, 2⅓ miles, is reported to have been let to Agee & Co., Birmingham, Ala.

A contract is reported to have been let to Bowdry & Wilcox for building a branch from

the main line of the Southern near Oakman, Ala., southwest 2½ miles to the property of the Atlas Coal Co.

SOUTHERN INDIANA.—This road, which runs from Terre Haute, Ind., southeast and east to Westport, 148 miles, is reported to have graded an extension from Terre Haute north to Humrick, Ill., 25 miles, on which six miles of track has been laid. The contract for a continuation of this extension from Humrick to Chicago Heights, 108 miles, is reportd to have been let to the Kinser Construction Co., 1747 Railway Exchange Building, Chicago, to be completed by November 1.

SPOKANE & INLAND (ELECTRIC).—Washington papers report that this electric road will be built from Spokane, Wash., into Palouse County. Contracts for grading the first 20 miles are to be let at once and the company expects to build between 30 and 40 miles this year. The road will later be extended 50 or 60 miles further. Jay P. Graves is President.

SPRINGFIELD & SOUTHWESTERN (MISSOURI PACIFIC).—An officer writes that surveys are being made for this road, which is projected from Springfield to a junction with the White River Railroad, now nearly finished. Contracts will be let and grading begun this spring.

TOLEDO, ANN ARBOR & DETROIT (ELECTRIC).—An officer writes that this road, which was recently incorporated in Ohio to build from Toledo across the Michigan state line and via Lambertville, Milan, Petersburg and Dundee to Ann Arbor, Mich., 55 miles, is under contract to the Patrick Hirsch Co., of 34 St. Clair Building, Toledo. J. H. Clauss, of Fremont, is President. (Dec. 9, p. 188.)

UNION PACIFIC.—An officer writes that the building of the Topeka & Northwestern from Menoken, Kan., to Onaga, 37.37 miles, is under contract to Kilpatrick Bros., of Beatrice, Neb. (October 28, p. 140.)

The same officer states that the contract for double-tracking the main line from Kansas City to Topeka, Kan., 67.36 miles, has been let to W. C. Bradbury, Railroad Building, Denver. Grading will be begun early this spring. (January 20, p. 24.)

WASHINGTON RAILROAD (OREGON RAILROAD & NAVIGATION).—Articles of incorporation of this company have been filed at Portland, Ore., by E. E. Calvin, General Traffic Manager of the Southern Pacific, William Crooks, J. C. Havely and Charles Steele to build this branch of the Oregon Railroad & Navigation Co. by extending the branch from Pomeroy, Wash., to Vineland or Clarkston, on the Snake River, just across from Lewiston, Idaho. The projected road also contemplates a junction with another road to be built up the Clearwater River from Lewiston to Grangeville and Mount Hope, as well as the building of a road up the south or middle fork of the Clearwater River to the Montana line. The company is reported also to have plans for building a road from Touchet to Prescott, in Walla Walla County; from Dayton south to the Oregon line, in Columbia County, and a line from Pendleton, Ore., south to the head of Birch Creek.

WASHINGTON ROADS.—An officer writes that the Eastern Washington Construction Co., a company organized in Washington with a capital of $500,000, has finished a survey for a railroad from Farmington, Wash., southeast to Princeton, Idaho, 20 miles, and has secured most of the rights of way. A contract has been made with the town of Farmington to build the road within two years from Farmington to Princeton. From Princeton, the road will be extended to Leland, Idaho. J. H. Abbott is President; W. J. Nichols, Secretary, and E. Tappan Tannatt, Chief Engineer, all of Spokane.

RAILROAD CORPORATION NEWS.

ATCHISON, TOPEKA & SANTA FE.—For the seven months ending January 31, 1905, the gross earnings of this system were $40,022,828, against $41,219,599 for the same period of 1904, a decrease of $1,196,771. Operating expenses were $25,874,055 in 1905, compared with $24,794,245 in 1904, an increase of $1,079,810. Net earnings decreased from $16,425,354 in 1905 to $14,148,773 in 1905, a decrease of $2,276,581. During this period there was an increase of 203 miles in average operated mileage.

This company is reported to have obtained control of the Arizona & Utah Railroad, which runs from Kingman, Ariz., to Chloride, 26 miles. For some months the Arizona & Utah has not been in operation because of damages by washouts and landslides.

BOSTON & MAINE.—This company has announced that holders of notes and bonds of the Fitchburg Railroad, maturing as follows: $591,000 notes, March 1; $691,000 notes, March 15; $740,000 notes, April 1; $1,500,000 notes, May 2, and $500,000 bonds, June 1, may refund these obligations in the 4 per cent. bonds of the Fitchburg due 1925. Clark, Dodge & Co., of New York, and Jackson & Curtis, of Boston, offer to make the exchange. Temporary receipts will be given, which will be exchanged for engraved bonds in May.

BUSH TERMINAL COMPANY (NEW YORK CITY).—F. J. Lisman & Co., of New York, are offering at 96¾ and interest $1,000,000 5 per cent. 50-year gold bonds of 1955 of this company, redeemable at par and interest on six months' notice, on and after January 1, 1915. The authorized issue is $10,000,000, of which $3,459,000 will be reserved to take up a like amount of first-mortgage 4s of 1902. There have been $1,500,000 of these bonds already issued as the purchase price of the Bush Co., Ltd. The Bush Terminal Co. owns large docks and warehouses in South Brooklyn, where freight is transferred to and from ships and railroads, most of the railroads terminating at New York harbor delivering cars there by floats.

CHICAGO JUNCTION.—N. W. Harris & Co. are offering at 101 and interest $1,500,000 first-mortgage 4 per cent. gold bonds of 1945, redeemable at 105 and interest after March 1, 1910. This is part of the $1,800,000 outstanding of the authorized issue of $2,258,000. These bonds will be secured by a first mortgage on the property leased to the South Side Elevated Co., which agrees to pay the interest, and will also be guaranteed by the Chicago Junction Railways & Union Stock Yards Co.

CONNECTICUT VALLEY (ELECTRIC).—Plans for consolidating the Greenfield & Turners Falls, the Greenfield, Deerfield & Northampton and the Northampton & Amherst street railway companies under the name of this company are outlined in a circular issued by the directors. The consolidated line would have about 50 miles of road, with an earning capacity, it is said, of about $175,000 a year.

ERIE.—The report of this company for seven months ending January 31 shows gross earnings of $27,129,347, compared with $26,803,103 for the same period a year ago, an increase of $326,244. Working expenses for this period in 1905 were $19,236,661, and in 1904, $19,783,103, a decrease of $546,443. This leaves an increase in net earnings of $872,687.

FARMVILLE & POWHATAN.—A decree has been entered in the Law and Equity Court at Richmond, Va., for the sale of this road at a date to be fixed by commissioners appointed by the court. The road runs from Bermuda Hundred, Chesterfield County, Va., to Farmville, Prince Edward County, Va., 88¾ miles. The minimum bid to be received for the road is $75,000. The total debts of the company are reported to be $1,121,439, one-half of which is bonded indebtedness.

INDIANA & MICHIGAN (ELECTRIC).—H. L. Crawford & Co., of New York, are offering for sale $200,000, the unsold balance of $750,000 first-lien 5 per cent. gold bonds of 1935 of this company, which operates electric lines between South Bend, Elkhart, Mishawaka and Buchanan, Ind. The entire issue, but no less part, is redeemable at 105 and interest.

LEHIGH VALLEY.—The report of this company for seven months ending January 31 shows gross earnings of $18,127,967, against $17,295,029 in 1904, and $13,592,123 in 1903. Operating expenses for the three years are respectively $10,828,617, $10,958,702, and $10,901,411, leaving net earnings of $7,299,350 in 1905, $6,336,326 in 1904, and $2,690,712 in 1903.

LOUISVILLE & NASHVILLE.—On March 28 the shareholders of this company will vote on the creation of a new mortgage to secure $50,000,000 or less of bonds. This mortgage will cover the Atlanta, Knoxville & Cincinnati division from Cincinnati, Ohio, via Knoxville, Tenn., to Atlanta, Ga., about 500 miles.

A vote will also be taken to ratify the purchase of the South & North Alabama.

MARYLAND, DELAWARE & VIRGINIA (PENNSYLVANIA).—This company is reported to have filed a mortgage deed of trust with the Girard Trust Co., of Philadelphia, for $2,000,000 to secure an issue of 50-year 5 per cent. bonds to that amount.

NEW JERSEY & HUDSON RIVER RAILWAY & FERRY COMPANY (ELECTRIC).—Millett, Roe & Hagen are offering at 87½ and interest part of $500,000 first mortgage 4 per cent. bonds of 1950 of this company. The company owns 20 miles of track, extending from the Edgewater (New Jersey) ferry terminal through Hackensack and Paterson, with a branch from Leonia to Englewood, and has a controlling interest in the Hudson River Traction Co., through which it operates 16 miles of road from Hackensack to Kearny, a suburb of Newark, with a branch to Lodi, near Passaic. The company also owns all the stock and bonds of the Riverside and Fort Lee Ferry Co., which operates a ferry line between West 130th street, New York, and Edgewater, N. J. These bonds are part of an issue of $2,245,000, which amount is outstanding of the $5,000,000 authorized.

NEW YORK CANADIAN PACIFIC.—An agreement has been filed with the Secretary of State at Albany, N. Y., consolidating the New York & Albany Railway Co., capital $5,000,000; the Schenectady & Albany, capital $150,000, and the New York Northern, capital, $5,000,000, under the name of the New York Canadian Pacific Railway. These companies hold franchises to build a line of railroad from New York City through Albany and the Adirondack region to Canada. Among the directors are: Verplanck Colvin, George C. Van Tuyl, Jr., and W. Howard Brown, of Albany; John McEncree, of Schenectady, and Peter H. Flagler, of Clarksville.

ST. LOUIS, BROWNSVILLE & MEXICO.—General Manager J. N. Miller is quoted as saying that this company has bought the Trinity & Brazos Valley, which runs from Cleburn, Texas, via Hillsboro to Mexia, and that an extension of the Trinity & Brazos Valley will be built from Mexia southeast to Houston, 130 miles; also that the St. Louis, Brownsville & Mexico will be extended northeast to Houston.

WARREN & CORSICANA PACIFIC.—Receivers have been appointed for this road, which runs from Warren, Tex., to Campwood, 18 miles, with an extension of one mile from Campwood. The road is the property of the J. I. Campbell Lumber Co., which, with the Tyler County Land Company, has been placed in the hands of the receivers for the railroad. S. F. Carter and W. H. Morris were appointed to take charge of the property.

WELLSBURG & BUFFALO VALLEY.—A bill has been filed in the Court of Chancery at Trenton, N. J., for the appointment of a receiver for this company, which owns the Washington & State Line Railroad, the Wellsburg & State Line, and the Wellsburg Coal Co. The company is charged with defaulting interest on its $1,000,000 outstanding bonds.